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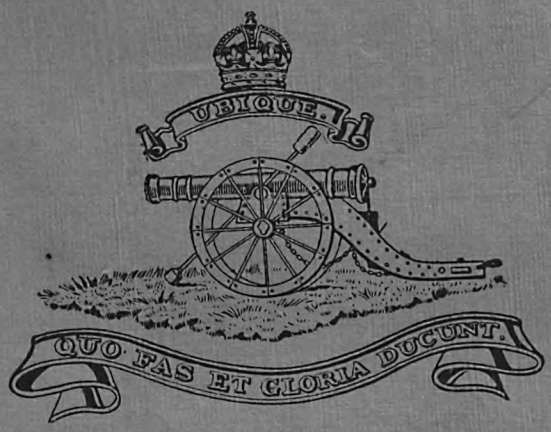

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BENGAL HORSE ARTILLERY, 1846.

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A DIVISION IN FUTURE WAR AND ITS PROBLEMS.

A Lecture delivered at the Royal Artillery Institution, Tuesday, 15th November, 1927.

By Major-General Sir Edmund Ironside, K.C.B., C.M.G., D.S.O.

Lieut.-General Sir Webb Gillman, K.C.B., K.C.M.G., D.S.O., in the Chair.

Chairman: Gentlemen, General Ironside needs no introduction from me. He has very kindly come down here to talk to you about the training of a Division, especially in the future, and I will ask him to go on with his lecture.

Sir Edmund Ironside: Gentlemen, the views which I am expressing here to-day are my own personal views and are in no way official. I want also to say that I am making no fanatical appeal for immediate and complete mechanisation of our Army, for I realise to the full that we are in a state of evolution, where it would be folly to embark upon any hurried scheme of production. No one can deny that the advent of armoured fighting vehicles and fast moving mechanical transport must alter both our organisation and tactics. I am therefore going to deal with what I think is to be the future of a Division, as quite distinct from a completely armoured force.

In training a division at Aldershot two things have struck me forcibly. First, the lack of mobility possessed by the main striking force of a division—12 battalions of infantry—and secondly the lack of offensive power possessed by this main striking force. If we follow the French ideas we shall have to increase our artillery strength in a division far beyond anything that we have at present. They make all their calculations upon the basis of artillery strength. They reason as follows. We have so many guns, and at 15 metres a gun that will allow us to attack such a frontage. For that frontage we will require so many infantrymen. They make an invariable rule of having a gun to every 15 metres in all attacks against an

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enemy's main position. We have not sufficient guns to do the like and therefore we must look to the tank to enable us to bring our infantrymen forward to their objective. I think, therefore, that tanks must be an integral part of a division. They have to work in such intimate close co-operation with the infantry that they cannot be lent for special occasions by a higher formation which keeps them as a reserve. The infantryman no longer has the power of brushing away resistance and preparing the battle for the final assault and he requires the tanks to be in the same formation as he is himself. I should like to see a division consisting of three fighting groups of all arms—infantry, tanks and artillery—trained to fight as a group. The power still remains in the hands of the divisional commander to use the tanks and artillery or infantry of any one of his groups to reinforce the others according to the terrain or the task in front of him.

Now as regards the question of cavalry. I think that a division must have cavalry in its composition. We suffered very much in 1918 in the last war for not having divisional cavalry. To send up cavalry when required is a difficult manœuvre, for moments when it can be employed are fleeting. Moreover, the ordinary routine duties of advanced and rear guards cannot be carried out without cavalry. As regards the mechanisation of cavalry, that is a question of the future, but having seen the various instruments we are now making, three-wheeled motor-bicycles, six-wheelers and semi-tracked machines, not to speak of small tanks or tankettes, I am firmly of opinion that with these we can do all the work now done by the soldier on a horse. It should be remembered that in peace we insist upon a meticulous close reconnaissance which is not necessary in war where bullets disclose position more easily. A division must then be a true division of all arms. As regards the proportions of arms nothing but trial and error in experiments will show us the proper organisation. I therefore urge that experiments be carried out with a division or at least a portion of a division. Administration, with all the different paces at which we now move, is becoming increasingly difficult and the staffs require much practice in this quarter.

If we take the progress of a battle we may analyse it roughly as follows:—The R.A.F. report what is going on in front and I

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think what we require of them is the disposition of the enemy in its large features. I want the R.A.F. to draw simple conclusions from what they see. I do not believe it is possible for a commander to draw an impression from a mosaic of little happenings represented on a map. The enemy will move so fast that the mosaic will not represent the actual picture unless it is drawn in large features only—that is to say, amount of movement on a road or in a given area, indications of increased activity and so on. As regards the link between the R.A.F. and the army I think that we have been wrong in inserting the B.I.O. into the chain of command of the R.A.F. I do not think it is right to reduce the commanders of R.A.F. units to the sphere of administration only. Just as a commander of a cavalry squadron draws his deductions from his patrols and compiles his report so should the commander of a R.A.F. squadron compile his reports. It is wrong to think that a well trained R.A.F. commander cannot do this work.

Behind the R.A.F. come the advanced guards. Their duty is to prepare the battle for the main bodies behind them. In reconnaissance they have two very important duties to perform—the location of the opposing anti-tank weapons and machine guns. When the main body attacks, these will be the two great enemies which have to be overcome. The advanced guard cavalry and infantry must close in to the enemy weapons and endeavour to snipe their detachments, preparing the attack for their own tanks if the opposition is too strong for them to overcome by themselves in the allotted time. I think that advanced guards must have tanks with them or they will never be able to sweep aside light opposition in a reasonable time and with reasonable loss. Both here in advanced guard work and later in bigger attacks we want the infantryman trained to skirmishing and sniping to a greater degree than has been the case of late. We want the training that was given to the infantryman in the American wars long ago. Individual rifle shooting is of the greatest importance.

Now we come to the main attack. The opportunity for the infantryman will be made by the tank. Tanks should work under cover of smoke or in the half-light of the morning or evening. We shall have the same support of the main attack by artillery and machine-gun fire and that attack will consist of a combined attack

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of tanks and infantry. The co-ordination of such an attack is most difficult. Two cases seem to present themselves, but in both the main idea is the same—to make the tanks and infantry converge upon the objective from different angles. By this you will tend to cause dispersion in the enemy's fire and facilitate the advance of both. The first case seems to be when it is proposed to employ the infantry already on the ground and to bring up tanks from behind. The infantry will be informed, if possible, of the approximate time at which the tanks will appear in the battle, and they must be trained to take instant advantage of the diversion caused and of the probable diminution of the enemy's fire which has brought them to a standstill. The tanks should be given a passing line, much after the manner of yachts—some definite and easily seen feature such as a road or hedge being chosen, usually from the map. In the second case, where the infantry on the ground are so exhausted or so hardly used that it is necessary to bring up fresh infantry, each of the attackers must be given a passing line; the timing of the infantry on their passing line being so arranged with that on the tank passing line that they are enabled to get forward before the tank attack is disclosed. In both cases, when the infantry get going they must move at their best pace—the double—and must endeavour to reach the objective as quickly after the tanks as possible, their aim being to deal with those parties of the enemy still remaining on the position and to enable the tanks to move on deeper into the position. To enable the infantryman to be a true light infantryman we must reduce the weight he carries and we must arrange to bring him to within a reasonable distance, say five miles, of his objective by other means than his feet. The long marching column of infantry makes it almost impossible to bring him up in time to co-operate with the tanks. Much can be done by the maintenance of a pool of transport within a division and by marching and carrying infantry. I do not think that a large pool of vehicles will be required for the bodies of infantry we shall now require. Also, I think we must drive this system of pooling transport as far as we can, discouraging the old private transport and reducing the actual first line transport to the very minimum. During the last manœuvres we had a system of hay-box cookery which proved eminently successful. Food was cooked at a cooking centre a good

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many miles back and delivered in containers in six-wheelers to the demand of the troops in front. This should at least do away with the private cooking vehicles. This method allowed us to do a good deal of pooling.

As regards tanks attacking at night. In certain countries—certainly the hedgerow country in which we had manœuvres—tanks were able to make a long approach march with accuracy and arrive at the required objective with certainty. I cannot imagine anything more devastating than a night attack by tanks, which might precede a dawn attack by say an hour. Even in peace the confusion in the internal arrangements of a position was great and transport and horse lines, which form the mobility of a force, are now exposed to sudden attack as never before. I do not recommend a combined attack of infantry and tanks in the darkness because the tanks could not discern friend from foe. Anti-tank defence is of pressing moment. We require guidance as to how far we are to develop this. The extent to which we develop this defence depends upon our potential enemy's organisation. Whatever that may be, I think that we should be prepared, at least on paper, with an organisation to meet the most highly armed enemy. Our units require an efficient weapon of defence against tanks and we want to evolve a drill to meet these new enemies just as we did to meet Zulus or cavalry. All fighting units must have these weapons and—against the first class enemy—we must have special units of them for the protection of non-fighting units. If we do not have them in sufficient number we must be prepared to have chaos reigning in whole areas.

I think that a theatre of war may be roughly divided into three areas—the base, the aerodrome, and the fighting area. Aerodromes with their numerous stores are not easily shifted and must be protected against the raids of armoured fighting vehicles. The area in which they are placed must be protected by defences capable of holding up armoured forces, defences which can be quickly put up—of the pill-box variety. These aerodrome areas must serve as havens of refuge for transport coming up from the base to the front. I think in future we must think in rapid movement from area to area during a given number of hours and not in a continuous stream. Protection to be given during certain

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hours, as is done in any hill picketing system. Staff officers must assume more central control of transport and indeed of all movement and must calculate in the number of hours required to fill one area from another rather than with a graph showing the position of units at any given moment. It will be the same thing with both troops and transport, the thing to aim at is very fast movement for short periods.

A word as regards artillery. It seems to me that the relative positions of the artillery and tanks is becoming very confused. The Birch gun is approaching very close to the tank and various new vehicles are being invented carrying guns of all calibres besides machine guns. The artillery is for the moment organised as a man-killer and a man-supporter, but if the tank is going to take the prominent part in war, which I think it is going to do, then this should be reconsidered to some degree.

It seems to me that there are two forms of weapon which are urgently needed. Firstly we want an anti-tank weapon. Its range of efficient penetration should be something between 1000 and 1500 yds. It should be armoured and have high mobility. It should have a flat trajectory and a rapid rate of fire. The actual weapon should be the smallest compatible with penetration—perhaps as low as one inch in calibre. These weapons should be present in the field in sufficient numbers, firstly with all fighting units and secondly in special units for the protection of non-fighting units. Secondly, we want a weapon of close support, which can deal with anti-tank weapons and machine guns. At the moment the light artillery with its mules is not mobile enough for the purpose of a support weapon. This support weapon should likewise be armoured and mobile. It should have a curved trajectory and should have a heavy shell, say 15 to 20 lbs. in weight. The position of these two proposed weapons in our organisation should be a matter of experiment. The first—the tank destroyer—must perhaps be an integral part of the fighting unit and able to manœuvre with it. The second should perhaps be an artillery weapon, or it may be merged into the tanks.

With the production of these two new types of weapons we can recommit the artillery to its proper duty, the support of the other arms in attack and defence. For the moment, with no anti-tank

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defence in fighting units, there is a general call for guns for dealing with tanks. The supply of artillery is very small in a division and we can spare none for anti-tank work. Moreover, the tactics of the artillery are being much confused. For anti-tank work you require guns well forward and for support work you want them further back. It seems impossible to combine the two requirements. The tactical result is nearly always a compromise, which is objectionable.

With all these mobile anti-tank weapons, motorised machine guns and tractor artillery, the divisional commander now has the power of sending forward very rapidly, behind an advanced guard, a skeleton of defence which will be able to hold its own for long periods. The infantry can then be brought up as required for night work generally and for counter-attack with tanks. Generally speaking, we must alter our idea from man-killing to machine-killing and our weapons must be designed to meet this new idea.

As I have already said, administration is becoming very difficult. Areas must be under central control for movement and subordinate units will not be able to move bodies of troops or transport without central authority in any area behind the fighting troops. Motor transport depends very much upon a one way traffic rule, and if delays occur owing to narrow roads used both ways, then the priceless mobility may all be lost.

CHAIRMAN: Would any officer like to make any remarks on either General Ironside's lecture, or anything cognate to it?

COLONEL RAWLINS: Might I add just a word or two with regard to the artillery? As I have been working with General Ironside all this summer, I naturally have no questions to ask him, but there are one or two artillery points which may be worth expanding somewhat. As General Ironside said, every time during this year's Collective Training that the "enemy" had tanks, we saw clearly that an artillery commander cannot be expected to deal with either tanks or infantry with all his guns; the natures of battery positions, methods of fire and systems of observation and inter-communication are very different for these two tasks. I am quite certain myself that we gunners can do a good deal more than is at present realised

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in the way of engaging tanks by means of indirect fire, and I have already started to tackle this problem. I have been struck by the slow progress of tanks, as soon as they encounter any appreciable slope and I am sure that we ought to be able to hit them, when moving slowly, by means of indirect fire. At the same time the afore-mentioned difficulties with regard to positions, etc., remain; so it boils down to the fact, I think, that a commander issuing orders to his artillery for an operation must definitely tell his senior gunner that for the moment tanks or infantry or cavalry, or whatever it may be, constitute the menace most to be feared and that, without going into precise figures, such and such a proportion of the available artillery should be detailed to deal with that menace. Unless that is done, I think that uncertainty will inhabit the mind of the gunner as to how to dispose of his artillery and that the best results would not be obtained. For the defensive we are trying out a definite plan of artillery dispositions. In the attack, on the other hand, we must be prepared to deal with a counter-attack by tanks; and this I regard, from an artillery aspect, as being one of the most difficult problems which we have to face. During this autumn's manœuvres, in undulating and fairly open country, we tried the plan of having one or two field guns working well forward, on the leap-frog system with the object of protecting the leading infantry against counter-attack by tanks. With so small an experience it would be premature to bless or condemn this method, but it appears to have merits. Guns well back or guns retained on wheels have, in my opinion, but very little chance of being able to intervene in time to meet a counter-attack by tanks.

There is one other point on which the lecturer has touched and which I should like to emphasise. The equipments with which divisional artillery are provided are emphatically excellent weapons of their kind. But they were expressly designed for man-killing or bombardment purposes and not for the destruction of tanks or even for picking off the elusive machine gun. Hence I personally feel strongly that we are in urgent need of some special weapons expressly designed to tackle these two targets.

COLONEL T.N. HOWARD : We have recently in the infantry, Sir, had a memorandum come round in the Eastern Command,

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which says that "the time has come to change our mentality." I suppose the same memorandum has been round everywhere. That seems to me very necessary, but also that it should be a human outlook. In the battle which Sir Edmund Ironside has described, I noticed he said that he thought the cavalry should be in armoured fighting vehicles. Well—the cavalry will then be in armoured vehicles, and the artillery are in armoured vehicles, but the infantry are on their feet and unprotected. Speaking with great feeling as an infantryman, it seems to me a somewhat inhuman war for us, and I suggest that there really is no rôle for the *unprotected* infantryman in the *armoured* battles of the future. I think it is asking too much of human nature. Also, personally, I think it will lead to a good deal of confusion of thought, that tank battalions will be carrying out in the armoured battles of the future the rôle of infantry battalions; they are the main blow. But that is what the infantry are there for. With great deference, therefore, I suggest that "The Royal Armoured Infantry" would have been a more appropriate title.

LIEUT.-COL. A. B. BEAUMAN (L. & Y.): There is one point I should like to bring up as an infantryman. The lecturer spoke of infantry in the future being transported more or less normally into action by means of buses. It strikes me that the first step before that becomes the normal procedure, is to do away with the present archaic first line transport and get transport that can keep up with infantry when carried in buses. I have noticed in the military journals, a certain amount of rather loose writing about infantry being transported long distances in buses and then coming into action; but I do not think anybody who has not had an intimate experience of infantry quite realises how helpless infantry is without its first line transport. On account of the weights that have to be carried about, infantry, without its first line transport, loses about 50 per cent. of its mobility; also without first line transport the flow of reserve ammunition cannot be kept going, and unless special arrangements are made for its supply, the infantry battalion, during a continuous fire fight, will soon become short of ammunition and therefore practically defenceless. It strikes me that the first thing we want to do in order to increase the mobility of the infantry and

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enable them to be moved long distances without losing their fighting efficiency is to mechanise the first line, that is the fighting transport, without which they are to a great extent helpless in mobile warfare.

GENERAL IRONSIDE: Gentlemen. Two points have been brought up to which I would like to reply. Of course, naturally, I am very strongly of opinion that we should maintain our present units with all their *esprit de corps* and prestige—that is to say, the 1st Bn. of the Essex Regiment must be changed into the new type of unit required. The second point is about the mechanisation of the first-line transport. That has already commenced. The 60th Rifles in my division are completely mechanised as regards their transport.

GENERAL DE PRÉE: Gentlemen, the question of an armoured force being effective, seems to me to depend to a very great extent on the power it has of dealing with anti-tank weapons. In the last war you dealt with anti-tank weapons by a tremendous barrage including smoke. General Ironside says we are not going to have it in future. If we are not going to have it you will have to develop the other new weapons which he proposed for dealing with anti-tank weapons, because unless you have something of that kind a mechanised force will probably soon be brought to a standstill by an army bristling with guns, like the armies in the last war. In the first battle of Cambrai there were 400 tanks with two corps—that is not a bad allowance of armoured vehicles. Even with that amount we did not make extraordinary progress against an army in position, and when we came to an unfavourable place at Flesquières—I daresay a good many of you remember it—the attack was stopped completely for the day. The infantry could not get on because of the wire of the unfinished Hindenburg Line. The tanks that tried to deal with it, as soon as they crossed the sky line, were shot by one or two German guns, and there were 14 or 15 tanks lying disabled there within five acres. Unless we have some means of dealing with these anti-tank weapons—and I think the infantry on foot will find it hard to do it—an armoured force will, in my opinion, find its limitations pretty quickly.

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CHAIRMAN: The two main points affecting the growth of mechanisation are:—

(1) The ubiquitious rôle our army has to play.

(2) Expense.

Even supposing a completely mechanised force were the most suitable for one theatre of war, there are many others such as Palestine, the Kabul line, or the recent theatre of operations against the Riffi in Morocco in which mechanised vehicles would be severely handicapped as regards mobility. It must also be borne in mind that nearly half the British army is in India, and that India is not at all anxious for mechanising fighting vehicles, and as I think all of you know, the 1st Field Brigade which has been mechanised for some years is to become a horsed brigade on its arrival in India in a few months' time.

Then as regards expense. The annual demand by the Chancellor of the Exchequer is to reduce Army Estimates. We cannot do this and at the same time produce armoured fighting vehicles.

There is one point in which I differ from the lecturer, and that is with regard to the menace of the tank. We have not had the money to develop anti-tank weapons since the war: we are experimenting and I think we are getting what we want. But at present the infantry see only one side of the picture. I am anxious to allay some of their nervousness and I feel that this will be allayed when we are able to provide anti-tank weapons to all units. At present there is the ever recurring competition between guns and armour, but I am fairly confident that the antidote will in a few years be able to compete with the present menace.

In conclusion I am sure you will agree with me in thanking General Ironside for coming here to-night, and for giving us so interesting a lecture. It will give us much food for reflection in the future.

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THE EXPERIMENTAL MECHANISED FORCE.

A Lecture delivered at the Royal Artillery Institution, Tuesday, 6th December, 1927.

By Colonel Commandant R. J. Collins, C.M.G., D.S.O.

Major-General E. H. Willis, C.B., C.M.G., in the Chair.

Chairman: Gentlemen, the subject of the Lecture to-night is "The Experimental Mechanised Force." I think we can consider ourselves extremely fortunate in having Colonel Collins as the lecturer. As you all know, he commands the Force, and therefore is in a better position than anyone else to tell us all about his experiences last year. I will now ask Colonel Collins to deliver his lecture.

1. *Introductory and historical.*

Colonel Collins: Those responsible for the Army have, from time immemorial, been criticised for their failure to move with the times. The military critics of that period no doubt took the Army authorities of the day severely to task for their lack of foresight and courage in failing to take the obvious first steps forward in the direction of replacing the bow by the musket. Some of us may yet live to hear ourselves referred to as "man and horse" soldiers, with as much contempt as was ever used when speaking of the "bow and arrow" generals of a hundred years ago. But it would be a foolhardy critic who took that line to-day. No one can deny that the authorities showed both foresight and courage in deciding to form the Experimental Mechanised Force which appeared this summer on Salisbury Plain.

Its immediate pre-decessor was the mobile column, consisting of the 7th Infantry Brigade with mechanised artillery, which was formed specially for the 1925 manœuvres. From this experiment at least one valuable lesson was learnt. In the report on those manœuvres appears the following sentence, epoch-making in its way:—"The horse must be eliminated from such columns."

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The present mechanised force is the direct outcome of that decision. It has been evolved in 18 months, not an overlong period considering the financial restrictions existing in times of peace. The horse has duly been eliminated. But it is only fair to say that in certain rôles that faithful friend and ally of the soldier has not yet been efficiently replaced.

In deciding that the Tank Battalion was to be the basic arm of the Force an almost equally big and farseeing decision was come to. Simultaneously with this came the alteration in F.S.R. II,[1] definitely deposing the infantry from its proud position as the sole winner of battles. These two changes may be said to represent a revolution in military thought, the results of which will not of course be seen for several decades yet, but which will have an increasing effect on military organisation. When addressing the senior officers of the Force at Tidworth in September last year, the C.I.G.S. referred to it as "only the germ of an idea which wants expanding." It is far too soon to say what its final form will be, but, even in the short time the Force has been in training, much has been learned, enough it might fairly be said to justify the cost of the experiment to date.

2. *Present object of experiment.*

Instructions were received that the Force was to be tried out in three rôles, strategical reconnaissance in place possibly of the independent cavalry, in co-operation with main forces, and on an independent operation at a distance. It was obvious from the outset that, largely for financial reasons, it would be difficult effectively to test the ability of the Force to undertake the first and last of these tasks, although at the same time it may reasonably be claimed that it has shown sufficient mobility and offensive power to be capable of doing so. It is not too much to say that it has given adequate proof of its capacity for carrying out the second task, viz., co-operation on the battlefield. It was a matter for regret that the cancelling of the Aldershot Command manœuvres prevented the Force being tested in co-operation with cavalry against a normal infantry division. The strength of such a com-

[1] F.S.R. II, Sec. 13, 1.

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bination needs no emphasis. More valuable lessons would no doubt have been learned.

3. *Composition.*

The number of light A.F.V's, e.g. armoured cars and tankettes, which should be included, has not yet been settled. Their tasks would appear to include both finding and fixing the enemy, so that the tank battalion—the main offensive weapon of the Force—may strike a decisive blow. A considerable number of both these light A.F.V's will, therefore, be necessary. The support, too, of the tank battalion cannot yet be effectively provided. Like its sister arm, the infantry, it will require covering fire from machine guns and artillery. The value of the tank, and the difficulty—at any rate at the outset of a war—of replacing both it and its highly trained crew, make such support more than ever necessary. The pendulum may for the moment have swung towards the tank. But the feverish search for efficient anti-tank measures will undoubtedly bring it back before long to the other side. Close support of the tank in an attack must bulk increasingly large in the future.

There are those, and amongst them many Gunners, who hold that only the tank, with its own gun and machine guns can provide the answer. There are others who see in this the rôle of the horse artillery of the future. They hold that the gun, mounted and armoured much like a tank, must accompany, or even precede, the tank into battle, the only difference in employment being that, unlike the tank, it will not assault or use shock tactics. At any rate, the dividing line between the Royal Artillery and its baby sister, the Royal Tank Corps, is already both a thin and flexible one, and it would be a brave man who would prophesy definitely where it will come to be drawn, say in ten years' time.

As regards the machine gun there can be little doubt that the newly invented battalion is not, in its present form the right answer to the problem, even when the gun teams can be carried in armoured vehicles. Opinion inclines towards the advisability of mounting the machine guns in tankettes, so as to avoid the waste of time and exposure of the teams entailed in manhandling the guns into action. But we have already realised that the organisation and handling of

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such a battalion is not going to be a simple matter. The revolutionary nature of the Force is best appreciated when it is realised that at present no infantry are included. Whether they can be altogether omitted remains to be seen. Even short experience has shown that there are a number of duties which can be as effectively and far more economically carried out by infantry than by A.F.V's, e.g., protection at the halt, while for one at least they are essential. In order to cross rivers, the commonest tank obstacle, men must first cross to protect the R.E. working parties. Without crippling other units, such men cannot be found. And they will obviously require to be highly trained in their special duties.

The necessity of including adequate numbers of Royal Engineers in the Force is obvious. Normal formations will seek safety from attack more than ever behind tank obstacles. The crossing of such obstacles, when circumstances will not permit of their being turned, will provide the R.E. with tasks worthy of their skill and ingenuity. Minefields, too, will develop. Counter measures will be required.

4. *Organisation.*

It was decided tentatively to organise the Force into three groups, light, medium and heavy, the grouping being very roughly by vehicles of homogeneous speed and cross-country capacity. To the light group, consisting of armoured cars and tankettes with sometimes the light battery, was entrusted the duty of reconnaissance, i.e., of finding the enemy. To the medium, consisting of the M.G. battalion and sometimes the light battery or a T.D. 18 pr. battery, the rôle of holding him when found, albeit the group was unsuitably composed for such a rôle; to the heavy group, consisting of the tanks and the bulk of the field artillery brigade, fell the obvious task of hitting him when found and held.

5. *Deductions from this year's experiences.*

It was obvious from the start that, with inadequate light A.F.V's for reconnaissance purposes, it might not be easy to locate the enemy. But thanks to excellent co-operation by the flight of close reconnaissance aeroplanes detailed to work with the Force and to

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superhuman efforts by the armoured cars and tankettes, informations of the enemy's whereabouts and movements by day was both plentiful and accurate. By night, however, it was a different matter and on two occasions, aided perhaps by a little luck, normal formations slipped past the Force. With the improved standard of training to be hoped for next year, it should be more difficult to escape. But mechanised forces, even more than normal formations, appear likely to suffer from the difficulty of pinning their enemy, more especially at night. It may be found advisable to include infantry for this and other purposes for which A.F.V's are not so suitable.

The ability of the Force both to approach and strike quickly is a great asset in effecting surprise. This, combined with doubt as to whether the enemy might not slip away, led on occasions to the main blow by the tank battalion being delivered with insufficient knowledge of the enemy's dispositions, with inadequate support by both machine guns and artillery fire, and with consequent casualties from the hostile anti-tank guns. The problem as to when and where the blow shall be struck is undoubtedly one of the most interesting of the many which have cropped up during training this year and is possibly the one which will be the acid test of the commander of a mechanised force.

Another obvious difficulty—but one which oddly enough has largely escaped the notice of many writers on mechanisation—is that of protection on the move. Much of the Force is at present vulnerable, seriously so in fact, to small arm fire. Even when, as is intended, every personnel-carrying vehicle is armoured, the Force will still be a prey to the anti-tank machine gun and to all artillery, if not also to the armour-piercing bullet. Unless grave risks are to be run protection on the move must, therefore be provided just as for normal formations. This entails protective troops searching all ground within range on either side of the route. But with a column averaging even 7 m.p.h. the protective troops must be able to move across country at least twice as fast or their work will be scamped. Even the tank—the most efficient cross-country vehicle we possess—could not do this. And even if it could it is obvious we could not afford enough of them to carry out this duty. This is perhaps the most difficult problem of all to solve, but until it is

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solved the mobility of such mechanised columns cannot be utilised to the full.

6. *Conclusions.*

There are many other such problems crying for solution, those on the administrative side being quite as numerous, as interesting, and perhaps more complicated. At times one may feel somewhat overwhelmed by them. The striking power of the Force is so great and the scope offered by its mobility so wide, that one is inclined to fret at being held back and hampered by such apparently trivial—and yet in fact important—questions, such as the supply of petrol, or the collection and evacuation of prisoners. For obviously without petrol the Force can only fight it out where it comes to a standstill. And, since prisoners cannot be disposed of wholesale, and if allowed to go free the moral effect of the Force is lessened, some arrangements have got to be made for coping with them.

But the great thing is to have the problems clear cut before you. Patience and continuous study will surely do the rest. From the little I have seen of the possibilities of the Force, I am convinced that there is no more important task before us now than their solution. And the more trained brains that are concentrated on this task, the sooner it will be satisfactorily completed. Hence the pleasure that it has given me to be allowed to outline some of the problems connected with mechanisation to you to-night and my gratitude to the Committee of the Royal Artillery Institution for giving me the opportunity of doing so.

CHAIRMAN: Has any gentleman any question to ask Colonel Collins?

LIEUT.-COL. LISTER: Would Colonel Collins tell us how he proposes to consolidate a position without any infantry when his mechanised force has captured it?

COLONEL COLLINS: I do not think that position attacking or position holding is going to play a very large part in the tactics of the Force. We have got to find the enemy and hit him. If he moves we go after him and try and hit him again as long as we

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can. When co-operating with normal forces, if expected to take a position, then I see the Force being given additional infantry for the purpose. It must be a battalion with mechanised transport. Although it will be unarmoured, and therefore will want careful protection, it can be brought up onto the position to be held. I think that is the answer to that. Normally our objective will be the opposing forces, and no more.

But there is another problem connected with this, on which I have not touched at all, that is, repair and maintenance. We are at work on that now, but the probability is that on every battlefield there will be a certain number of temporary immovable vehicles, tanks and possibly dragons, with damage which can be repaired in a moderately short time, broken tracks, for instance. Therefore we may want to stay on the battlefield in order to pick them up and take them away. Except for this I do not think that there will be any lengthy stay on a position *qua* position.

LIEUT.-COL. LISTER: In the manœuvres we captured a position and we were adjudged to have won. They sounded the cease fire the moment we got there. I maintain that you cannot stay there.

COLONEL COLLINS: No, tanks certainly cannot.

LIEUT.-COL. LISTER: They will all get knocked out.

COLONEL COLLINS: Yes.

COLONEL BEAUMAN: Could you tell us what is your system of night protection?

COLONEL COLLINS: The way we are working it out at present is by "laagers"; we have gone back to the old Dutch word. We get into as small a perimeter as we can with a certain disposition of armoured fighting vehicles, which is designed to produce an overwhelming fire in all directions. That is quite easy. We picket the enemy with tankettes or armoured cars, the latter for choice, because they are quiet. But we are looking for a silent motor cycle to do it better, as it is a waste of an armoured car. The ordinary motor cycle gives itself away. But obviously we can picket at any distance, and we must go for that. We then limit anything

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in between to the absolute minimum. We aim at having pickets watching the enemy at any distance, rather after the Dutch fashion again, or listening posts out at cross roads, 10 or 15 miles away. Distance is no object. The danger lies in the air. I am but little afraid of artillery fire being brought on to us by night, because as a rule we shall not stay so close to the enemy as to make that feasible, but I am afraid of bombing, particularly with the aid of parachute flares.

LIEUT.-COL. WATERHOUSE: There is one small point about your holding force. To what extent can the tankettes go through obstacles like hedges and wire fences, over small ditches, and that sort of thing?

COLONEL COLLINS: Their cross-country capacity is at present small. A bank, or anything like that, causes trouble, but there is nearly always a way round; it merely means that they will be slower. I am quite prepared to admit that conditions on Salisbury Plain are easy; but remember it cuts both ways, because your anti-tank artillery has a field of fire which it will never have in a close country. The advantage may possibly be a great deal more on the side of the normal formation in close country, but their defensive problem also will be greater. The tankette at present is absolutely in its infancy. The one that we used is already out of date. I believe that the new design is a great advance on the last, and it will probably have fair cross-country capacity. The new armoured cars are going to be six-wheelers, with a very fair cross-country capacity.

LIEUT.-COL WATERHOUSE: Are the six-wheelers the heavy ones?

COLONEL COLLINS: I think the weight will be the same as at present; they will be no heavier, I hope. The pace of course slows down tremendously the moment you go over any sort of give and take country. I have not yet carried out any hedge crossing experiments. In the spring we shall have some practical tests by ordinary average drivers, a very different affair to those carried out by the experts.

COLONEL ROWAN-ROBINSON: I must apologise to the Lecturer if I ask a question rather beyond his experience, but I rather want

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to clear my own mind on a matter that I find very puzzling. I gather that he has only tackled the problem of acting in command of a mechanised force against other troops not mechanised, but when we come to deal with two mechanised forces, the problem that becomes extraordinarily difficult is that of command. The two forces will be approaching each other at double the rate of movement of the present mechanised force; that is to say, the rate of approach may be anything from 10 to 80 miles an hour, and the problem of command both of the supporting artillery and of the force itself seem to me very nearly insoluble from the ground. I want to ask the Lecturer what his views are on commanding both the artillery and the whole force from the air. Of course the answer to that has endless implications, but, with that rate of approach, unless you are commanding your artillery from the air, I do not see what chance there is of engaging the enemy, or of your guns being able to follow and cover your own forces. I understand that umpiring on the ground was found extremely difficult in the tank battle, and I take it that in all the peace training we shall have not only to command from the air, but to umpire from the air. I am sorry to ask questions which I know are not about what you have been doing this year, but I really want to know what your views are.

COLONEL COLLINS: My own personal opinion, which is not of any great value, because I have not really had any chance either of trying it or thinking about it very much, is that I do not believe that you will be able to control or command from the air personally. I think you will give up so much by attempting to do so. What Colonel Rowan-Robinson has said brings out an interesting point, and that is the parallel with the navy. We find continually that we are beginning to think in naval terms. The problem of command and communications is a very difficult one, but at the battle of Jutland, when the battle cruisers approached each other, I think, at a combined speed of about 50 miles an hour, it is worth while remembering that somebody was able to control them fairly well. But personally I do not think that control from the air is the answer, because once in the air, supposing you have got a big enough machine to carry the additional Staff officers, and your

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wireless expert, I do not believe that you could get all the information in the same way as on the ground. Your information even now comes in at an extraordinary speed; you have got continuous wireless information probably from two or three sources. We have almost continuous radio telephony with the observer in the air. All that has got to be collated and plotted. You have got to rely, in my opinion, upon two things for efficiency in command: Firstly and foremost, a "normal drill" which we are now studying and which the Chief of the Imperial General Staff put us on to. Secondly, simple orders for attack. There will often be time to give nothing more than the direction of the attack, once you have got a sufficient knowledge from the air and ground and other sources of information of where the hostile column is. I think you will give the direction of attack, possibly a frontage, and the rest will have to be automatic. As to your supporting artillery, they will know where they have got to go and what their job is, and it will be simply a drill and nothing else. That is an extreme case when speed is everything; but I do not see at present, although I do not say it is impossible at all, that control from the air is feasible; I think it is too complicated.

COLONEL ROWAN-ROBINSON: I take it, however, the question will be seriously considered as a possible means of solving the problem.

COLONEL COLLINS: Yes. But I have found controlling on the floor quite sufficient for the time being, and I am prepared to stay there.

MAJOR CLUTTERBUCK: One small point. You mentioned petrol and bombing. Do you think the danger from petrol is so serious that the question of going for a heavy fuel engine or a less inflammable fuel engine is very vital or not?

COLONEL COLLINS: They say that there is an efficient coal gas engine. If we could get on to heavy oil it would be an advantage, because, I believe, it is much less inflammable. Fire is always going to be a danger. For the moment, we are all against having petrol tanks; we prefer tins, because we think they will be less inflammable and also because they are easier to handle. We would like to get

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a self-sealing tank for petrol, but the Air Force have been after that for years and, I believe, have not got it yet. It is extremely hard to tell what the effect of air bombing will be. All I can say is that some of the Royal Air Force, who have flown over the Force, have told me that they have found it more elusive and more difficult to follow than expected. It has a habit of disappearing unless you keep a close watch on it.

LIEUT. GILLESPIE, R.E.: Have any successful methods of defence been devised against such a force?

COLONEL COLLINS: I do not think that question ought to be put to me. I do not want to boast. I have merely told you of the difficulties of the Force. I have said nothing about the other side; you had better ask the other people; but in training on the Plain the infantry started, in the good old fashioned way, as escort to the guns. At the end of a fortnight the guns were escorting the infantry. I will leave it at that.

CAPTAIN OLDHAM, R.N.: I think there are naval analogies which may be of interest in considering the use of a mechanised force, and I would like to ask the Lecturer which is the most prominent problem in the mind of the army—the proposal to use this mechanised force as a separate unit, or the proposal to use it in combination with other arms, because it strikes me as being rather analogous in a way to the use of destroyers. The Lecturer spoke about the mechanised force being capable of hitting hard. A destroyer also can hit hard, but she can only hit hard under certain conditions, and those are that she is well supported; and the principal means that a destroyer has of support in her attack, are the guns of the battleships and cruisers. So far, in the case of the mechanised force, I gather that the main unit in attack is the tank battalion, and that seems to be rather analogous to a destroyer attack, since, as the Lecturer pointed out, he was up against similar difficulties both as regards support and of protecting his force in movement. The answer seems to be, simply looking at it from the point of view of this analogy, that the force is not suitable yet to be separated from the main army; just the same as destroyers cannot be separated from battleships and cruiser support in daylight if you

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want them to be effective. Therefore, although no doubt it may be necessary to consider the means of handling the mechanised force when separated from the support of the main body, the primary problem strikes one as being how they can best be combined with the main body. If you have not got sufficient support, presumably it is up to the artillery to produce it. If you cannot operate your reconnaissance screen without 18 pr. guns slipping through your fingers as you go along, then there must be some means of connecting it up. That is really the purpose of the question I ask, because the first and bigger problem seems to be how you are going to combine, and then afterwards, to what extent you can separate from the main army and work alone?

COLONEL COLLINS: I think I would like to reply first of all by asking this question of you: Is there any record in the late war of your battleships having in daylight been able to afford sufficiently good artillery support for your destroyers to get in?

CAPTAIN OLDHAM: I do not think our destroyers ever actually made a daylight attack in conjunction with battleships.

COLONEL COLLINS: Why?

CAPTAIN OLDHAM: I cannot tell you the reason why. The German destroyers attacked at Jutland.

COLONEL COLLINS: They had practised it before the war, had they not, incessantly?

CAPTAIN OLDHAM: I do not know that they had practised it any more than we had.

COLONEL COLLINS: No, but I mean both sides had practised it. Our destroyers had practised it.

CAPTAIN OLDHAM: Yes, they had practised it a good deal before the war.

COLONEL COLLINS: But it was not brought off.

CAPTAIN OLDHAM: No. But you must remember that we had only one action in which the battle fleet was engaged. German

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destroyers attacked, and besides the protection of their fleet they used another form of protection as well, which was a smoke screen.

CAPTAIN ARBUTHNOT: And there is also no doubt that at Jutland light cruisers were employed to support our destroyers, so that even if you cannot get the capital ships' guns to help them, they have the guns of the heavier armed ships.

COLONEL COLLINS: Yes, but I do not think the parallel of the destroyer and the tank is a correct one.

CAPTAIN OLDHAM: No, not altogether exact, but the principle seems to hold.

COLONEL COLLINS: I do not think so. I am in as close touch with the senior service as possible, because there is an enormous amount to be learned from them—for example in communications. I think we have got to come to you to find the answer to that. But I do not think the parallel as regards the destroyer is a very close one, because in the mechanised force the heaviest ship we have got, the tank, goes into the assault; it is an assaulting weapon. It is rather different. Your destroyers are, I think, more the armoured cars, that is, the scouts. And of course there is the one fundamental difficulty I find always in studying naval problems, namely, that of visibility. We are of course considering smoke screens very closely. The smoke screen by emission from the exhaust, just the same as you do, has got to come.

CAPTAIN OLDHAM: But you ask for support in assault nevertheless, and it seems either a question of using the artillery of the main body or of producing a bigger tank that can give you the support.

COLONEL COLLINS: Yes, but I do not think the form of support is the same, either. I do not know. I think our support problem is more difficult possibly because we cannot get the gunnery efficiency in movement that you have. Although some of our tank gunners have put up, I believe, good performances in the "Excellent" with your tests there, they cannot produce accuracy of fire over rough ground. We have got a short chassis. You have only got to spend a few minutes in a tank to realise the great difficulty of bringing efficient fire to bear in movement. That is

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why I put that problem to-night: Close support is one of the most difficult problems of all, but our difficulty is the platform.

CHAIRMAN: If no other gentleman has any questions to ask, I had better sum up. As a gunner, a most interesting question on the lecture was when Lieut. Gillespie asked how they were going to counter these armoured machines of Colonel Collins' force. Now what is our present organisation of a division? We still have 12 battalions of infantry. As long as we have this strength in rifles and automatics so long must we continue to master all the methods laid down in our manuals for supporting infantry. As the number of rifles is reduced and their fire power replaced by armoured vehicles, our methods as well as our weapons must alter accordingly. Now to work up to this gradual evolution whilst still keeping thoroughly *au fait* at supporting these 12 battalions, what should we do? Well, for one thing, learn to shoot at moving targets from under-cover positions. It is not easy and we have not practised it lately in England, but I can assure you that after really tackling the problem the results should surprise you. Once a battery is sufficiently trained to keep its M.P.I. on a fast moving target the engaging of jumpers and fleeting opportunity targets becomes child's play. Reach this standard, then when the M.G.O. can give us easier weapons to handle against moving targets results should be good. When you consider the matter you will realise that jumper targets, though very useful for quickening you up, do not provide the crux, namely the art of prediction. Each line of jumpers as they are pulled up give you a standing "fleeting opportunity" target. The A.A. and coast artillery are confronted with the difficulties of prediction, and are hard at work trying to solve them. The field artillery must do likewise if we are to counter the armoured vehicles successfully.

Another point the lecturer touched on which is of great interest to us gunners is that of "close support" artillery. There is a para. in F.S.R. which I will try and repeat to you. "The ideal form of artillery support is that in which fire can be directed by observers so placed as to be able to follow closely the progress of the attack and at the same time with secure communications to their guns. The nature of the ground as well as dust, smoke and mist will seldom allow of this form of support and since communications from

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observer to gun cannot be assured, artillery fire based on such factors can never be certain." I believe we have Colonel Collins to thank for that paragraph. The ideal form of artillery fire, mark you, is observed fire. For "close support" does not the gun in an armoured vehicle look like the remedy to solve the problem of observer and gun being secure in their communications with each other?

Gentlemen: It now only rests with me to ask you to join me in giving a hearty vote of thanks to Colonel Collins for his very interesting and instructive lecture.

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N/5 R.A. IN THE ZULU WAR OF 1879.

By Major-General J. C. Dalton, Colonel Commandant, R.A.

THE sympathetic and well deserved appreciation of the late Maj. Genl. Arthur Harness, R.A. (2611)[1] which appeared in the November number of the R.A. Regimental News brought to my mind many memories of old N/5—now 86th Field Battery—with which I was connected from its birth for six years; also that I had in my possession the original letters from my old friend, the late Colonel H. T. Curling, copies of which were given to me by his mother, to whom they were addressed, and dated, from Helpmakaar, on January 28th and 30th and February 2nd, 1879. I do not propose to do much more than briefly to supplement the last of these letters by a little contemporaneous history, but would refer my readers to the admirable first-hand description of this sad affair given in General Sir H. Smith-Dorrien's "Forty-eight Years of Service," a work which has been widely read. I am indebted to him for the use of the maps which accompany this paper and which illustrate so simply and clearly the events of that fateful day. I have also availed myself of the Official History of the Zulu War, and of the valuable *précis* of the campaign in the *Encyclopædia Britannica* for a few historical details. The battery arrived in South Africa in January 1878, and took part in the sixth Kafir campaign under General Sir A. Cunnyngham from whom General Thesiger took over command in South Africa in March 1878, with a total British force of some 5000. This small war was over in June, and a general amnesty followed, the troops being withdrawn to the Transvaal on the borders of Zululand.

In April of the preceding year, Great Britain had formally annexed the Transvaal, and the responsibilities therewith taken over included a long-standing boundary dispute between the Boers and the Zulu nation, to settle which a Boundary Commission was

The numbers in brackets are those of Kane's List of R.A. Officers.

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appointed, the report of which was to be referred to Sir Bartle Frere, then High Commissioner for South Africa, and forwarded by him. Owing doubtless to the known character of the Zulu King Cetewayo and his despotic rule, Sir Bartle was himself rather inclined to side with the Boers, though the Commission reported in favour of the Zulus' contention. Sir Bartle, however, came to the conclusion that the peace of South Africa could be preserved only if the powers of Cetewayo were curtailed. He therefore, in forwarding the award on the boundary dispute, demanded amongst other points—eleven in all—that the Zulu military system should be remodelled, reform of the marriage laws of young men, proper treatment of missionaries, acceptance of a British Resident. etc. These stipulations were delivered to Cetewayo on 11th December 1878 and a reply called for before 31st December. No reply being forthcoming, General Thesiger (later Lord Chelmsford) invaded Zululand. The force at his disposal was some 6500 white troops, 8000 native friendlies, with a reserve of 1400 Europeans and 400 natives in the Utrecht district. The objective was the King's kraal at Ulundi, and the advance was to be in three columns from the Lower Tugela, Rorke's Drift and Utrecht. They entered Zululand unopposed, and the central column, with which we have to deal chiefly, encamped near Isandhlwana on 20th January. (See Maps 1 and 2.) On the memorable 22nd January Lord Chelmsford left the camp at daybreak with a small force consisting of Lt. Col. Harness' Battery, N/5, with four guns, some mounted infantry and six companies of the 2/24th Regiment, to support a reconnoitring party thrown out to the eastward under Major Dartnell, and he ordered up Lt.-Col. A. W. Durnford, R.E., from Rorke's Drift[1] to take command of the camp which was then occupied by the other two guns and 70 men of N/5 R.A. under Lieut. Curling, the 1/24th British Regiment, 5 companies and one of the 2/24th, 30 mounted infantry, about 100 white men and 1000 armed natives. Colonel Durnford arrived at 10 a.m. and at once moved out to reconnoitre. Some Zulus were observed, though not enough to arouse suspicion, but about noon a large body was seen advancing on the camp, and

[1] With Bt. Maj. F. B. Russell, R.A. (3041) and Rocket Battery (3 tubes on pack mules), 1 officer and 1 Br. R.A., and 8 men of 1/24 Regiment (10 in all); also some mounted natives. They were out in advance and were in action on 22nd about 11.30 a.m. and were overwhelmed by the Impi and perished.

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the troops were turned out at once. At this moment Bt. Major Stuart Smith, R.A. (3087) arrived from N/5 and took over from Curling. The further proceedings are best described by the last named's letter, viz. :—

HELPMAKAAR,
NATAL,
February, 2nd, 1879.

"Now things have quieted down again a little, I can tell you more about what has happened. I trust you had no false reports; I saw the first man who went into Pieter Maritzburg with the news, so I hope you may have had no anxiety. On the morning of the fight the main body left at 3.30 a.m. a little before daylight, leaving me with two guns and about seventy men. About 7.30 a.m., we were turned out, as about one thousand Zulus were seen on some hills about two miles from the camp. We did not think anything of it, and I was congratulating myself on having an independent command. I had out, with my guns, only twenty men, the remainder, fifty in number, stayed in the camp. We remained formed up in front of the camp (it was about half a mile long) until 11 o'clock, when, the enemy disappearing behind some hills on our left, we returned to camp. We none of us had the least idea that the Zulus contemplated attacking the camp, and having in the last war *(Kafir war, 1878)* often seen equally large bodies of the enemy, never dreamt they would come on. Besides, we had about six hundred troops (regulars) two guns, about one hundred other white men, and at least one thousand armed natives. About twelve, as the men were getting their dinner, the alarm was again given, and we turned out at once. Major (Stuart) Smith came back from the General's force at this time, and took command; this, of course relieved me from all responsibility as to the movement of the guns. We, being mounted, moved off before the infantry, and took up a position to the left front of the camp, whence we were able to throw shells into a large mass of the enemy that remained almost stationary. The 24th Regiment came up and formed in skirmishing order on both our flanks. The Zulus soon split up into a large mass of skirmishers that extended as far round the camp as we could see. One could form no idea of

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numbers, but the hills were black with them. They advanced steadily in the face of the infantry and our guns, and I believe the whole of the natives who defended the rear of the camp soon bolted and left only one side of the camp defended. Very soon bullets began to whistle about our heads, and the men to fall. The Zulus still continued to advance and we began to fire case, but an order was given to retire after firing a round or two. At this time out of my small detachment one man had been killed, shot through the head, another wounded, shot through the side, and another through the wrist. Major Smith was also shot through the arm but was able to do his duty. Of course, no wounded man was attended to, there was no time or men to spare. When we got the order to retire we limbered up at once, but were hardly in time as the Zulus were on us at once, and one man was killed (stabbed) as he was mounting on a seat on the gun carriage. Most of the gunners were on foot, as there was not time to mount them on the guns. We trotted off to the camp, thinking to take up another position there, but found it in possession of the enemy, who were killing the men as they came out of their tents. We went right through them, and out the other side, losing nearly all our gunners in doing so, and one of the two sergeants. The road to Rorke's Drift that we hoped to retreat by was full of the enemy, so no way being open we followed a crowd of natives and camp followers, who were running down a ravine. The Zulus were all among them stabbing men as they ran. The ravine got steeper and steeper, and finally the guns stuck, and could get no further. In a moment the Zulus closed in and the drivers who now alone remained were pulled off their horses and killed. I did not see Major Smith at this moment but was with him a minute before. The guns could not be spiked, there was no time to think of anything, and we hoped to save the guns up to the last moment. As soon as the guns were taken, I galloped off and made off with the crowd. How any of us escaped I don't know; the Zulus were all among us, and I saw men falling all round. We rode for about 5 miles hotly pursued by the Zulus, when we came to a cliff overhanging a river. We had to climb down the face of this cliff and not more than half of those who started from the top got to the bottom. Many fell right down, among others Major Smith, and

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the Zulus caught us up here, and shot us as we climbed down. I got down safely, and came to the river, which was very deep and swift. Numbers were being swept away as they tried to cross, and others were shot from above. My horse fortunately swam straight across, although I had three or four men hanging on to his tail, stirrup-leathers, etc. After crossing the river we were in com parative safety, though many were killed afterwards, who were on foot and unable to keep up. It seems to me like a dream. I cannot realise it at all. The whole affair did not last an hour from beginning to end. Many got away from the camp but were killed in the retreat. No officer or men of the 24th Regiment could escape; they were all on foot, and on the other side of the camp. I saw two of them, who were not with their men, near the river, but their bodies were found afterwards on our side of the river. Of the fifty men we left in the camp eight managed to escape on spare horses we had left in camp. One sergeant (Edwards) only of my detachment got away. Altogether we lost sixty-two men and twenty-four horses—just half the battery. Those who have escaped have not a rag left, as they came away in their shirt sleeves. We always sleep at night in the fort, or laager (as it is called), and in the open air. It is very unpleasant, as it rains every night, and is very cold. We none of us have more than one blanket each, so you can see we are having a rough time. The first few days I was utterly done up, but have pulled round all right now. What is going to happen no one knows. We have made a strong intrenchment, and are pretty safe even should we be attacked. The only thing we are afraid of is sickness. There are fifty sick and wounded already, who are all jammed up at night in the fort. The smell is terrible. Eight hundred men cooped up in so small a place. Food fortunately is plentiful, and we have at least three months' supply. All spies taken are shot; we have disposed of three or four already; Formerly, they were allowed anywhere, and our disaster is to a great extent due to their accurate information of the General's movements. What excitement this will cause in England and what indignation. The troops, of course, were badly placed, and the arrangements for defending the camp indifferent, but there should have been enough troops; and the risk of leaving a small force to be attacked by ten or fifteen times its

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number should not have been allowed. As you have heard there were no wounded—all the wounded were killed, and in a most horrible way. I saw several wounded men during the retreat all crying out for help, as they knew the terrible fate in store for them. Smith-Dorrien, a young fellow in the 95th Regiment, I saw dismount and try to help one. His horse was killed in a minute by an assegai, and he had to run for his life, only escaping by a miracle . . . .

We hear the General has telegraphed for six regiments and a cavalry brigade. Even with these troops it will take a long time to finish the war. It takes months to accustom troops to the country, and, in fact, they are quite unfit for fighting in the field, as they require such enormous baggage trains. The colonial troops move without anything, and always sleep in the open. We shall get no assistance from the natives now, as they do not believe in us any more. All those who escaped have sent in reports, by order, which will probably be published, so you will have eventually the truth about this sad disaster . . . .[1]

[Sd.] H. T. CURLING."

Space forbids anything more than the briefest summary of what followed. The Zulus, flushed with victory, who had pursued the fugitives, directed their steps to Rorke's Drift, where Lieuts. Chard R.E. and Bromhead 1/24th and others staved off seven violent attacks and saved the situation by their magnificent defence. Lord Chelmsford cabled for reinforcements from England and meanwhile recuperated his force. Lt.-Col. Harness in an incredibly short space of time reorganised his battery, and led it to victory at Ulundi on 4th July, which virtually terminated the war.

Lord Wolseley landed at Durban on 28th June and was sworn in as High Commissioner two days later. After failing in his attempt to land at Port Durnford he returned to Durban, and there heard of the victory of Ulundi. Lord Chelmsford handed over his command to Lord Wolseley and embarked for England. Cetewayo, who had fled after Ulundi, was hunted down and finally captured on 29th August.

[1] General Smith-Dorrien, who has seen the above letters, authorises me to say that they give a modest and truthful account of the tragic incidents of that day. J.C.D.

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NOTES ON THE HISTORY OF N/5 R.A.[1]

Earliest reminiscences.

In 1870-71 in consequence of the Franco-German War, a careful overhaul of the British Army was taken in hand. Short service, abolition of purchase, and reforms in drill and tactics were brought in, and it was decided to increase the Army by 20,000 men, 5000 being added to the R.A. in order to provide 6 new horse and 20 field batteries. This, as regards the field artillery, was effected by converting the First Brigade into a field brigade, by reducing certain garrison batteries and by forming some ten or so new field batteries to be added to the existing field brigades.

Amongst the garrison units reduced was No. 8 of the 15th Bde. in which the present writer (3273) was serving at Gibraltar, and he, with Capt. W. H. Izod (2456) and Lieut. H. T. Curling (3245), were ordered home to Devonport in February 1871 and posted to K/11 R.A., to be formed there under the command of Captain E. P. B. Turner (2294). The third subaltern was Lieut. R. C. Corbett (3338).[2] All met in New Granby Barracks, Devonport, in March 1871. A small nucleus of N.C.O's and men had joined, and thenceforward the work of training began; men, equipment and later, horses, came in by driblets, the gradual sorting and assembling of the various components forming an excellent experience for the young officers and soldiers. The battery was at first armed with six 12 pr. R.B.L. guns, six wagons, extra carriages, full camp equipment, ammunition, etc. Truly, a complete machine. The horses soon began to arrive, mostly remounts, fine blacks and browns, from Yorkshire, and had to be trained. I well remember our pleasure when the first batch of twelve arrived, just in time to swell the glamour of a review on Roborough Down—some seven miles by road. The G.O.C. directed an officer to march with them to the scene of action to keep the ground, and I recollect my envy of the fortunate officer (Curling) who was detailed for that important duty! On the return of the party in the late afternoon, I asked the Sergt.-Major how they got on. His reply was characteristic,

[1] The numbers in brackets refer to Kane's List of Officers.

[2] The only surviving officers of K/11 are Lt.-Col. W. H. Steele, late R.A.M.C., R. C. Corbett, Esq., late R.H.A., and the writer.

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"Oh ! very well, Sir, on the 'ole, but it was just like a blacksmith's shop going along the road," meaning that the young horses "forged."

The training of the battery proceeded successfully, but before we were ready to turn out in the drill field the Inspector General R.A., the late Sir Collingwood Dickson, VC. (K.1874) visited us. I have never forgotten that inspection, which was held in the barrack square. All went well till we came to the gun park where we subalterns were questioned by the great man at the guns. We had been well primed, but were had properly when we were called upon to describe the contents of the limber boxes. Here we displayed our ignorance—"Oh ! Gentlemen, this is lamentable" ! However, he gave us quite a favourable report, and the following year all was serene.[1]

Our nice 12 prs. were soon taken from us, and a very different equipment sent us—the 16 pr. R.M.L. of 12 cwt. When we took them to Staddon Heights soon after, to do our first annual practice at a moored target in the sea, and fired service charges, *all* the axletrees gave out, and we had ignominously to march back to barracks through the streets of Plymouth, with the guns slung under the limbers, and the carriages, etc., packed on the wagon bodies.

In 1873 the battery took part in the autumn manœuvres on Dartmoor, memorable for the fact that it rained steadily for the entire month. We were under canvas; the bogs for which Dartmoor is famous, were intensified, and the rivers were in flood, so much so that our Q.M. General, Colonel Mackenzie, was drowned when crossing one. These manœuvres were immortalised by the inimitable pencil of Lieut. (now Col.) L. Fawkes R.A. (3348). Despite the weather we enjoyed it and profited. From the manœuvres we marched into the Higher Barracks, Exeter, and in 1874, on by road to Aldershot, where we became K/16, and were brigaded with F/16 under Lt.-Col. A. H. Heath, R.A. (late Bengal). Capt. Izod was succeeded by Capt. S. Simpson (2724) in 1872, who soon exchanged with Capt. E. D. Tarleton (2576), and he gave place to Capt. P. C. Whalley (2527). At Aldershot the 16 pr. batteries took their gunners and guns to Shoeburyness for their

[1] See photograph of K/11 taken at New Granby Barracks, Devonport, in 1872, reproduced by Davey of Harrogate.

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practice, leaving the horses and drivers behind. Here the officers were under canvas. All enjoyed the outing—which was instructive—apparently the gunners in particular, from a remark I overheard, when lying out waiting till the range cleared, by a gunner to his mates—"I'd loike to stay on 'ere for ever, if only to get away from them —— droivers."

When I left, in January 1876, to join A/D, I was succeeded by Lieut. (later Sir) C. S. Parsons (3586), and in January 1878, the battery, which had become K/16, F/24 and N/5 in 1874, 1875 and 1877 respectively, was ordered out to South Africa under command of Major A. Harness (2611) who had relieved Major Turner in August 1876. Capt. J. R. Davies-Cooke (2636) had succeeded Capt. Whalley in 1875-6, and was replaced by Capt. Stuart Smith. On arrival in South Africa the battery at once went on active service in Kaffraria, attached to Colonel Evelyn Wood's column. This campaign ended in June 1878. During part of this time Lieut. A. J. Bigge, R.A. (3305)—now Lt.-Col. Lord Stamfordham—was attached to the battery, in charge of a rocket party, during an arduous trek of 10 weeks, from King Williamstown to Pietermaritzburg, and saw considerable service afterwards under that gallant leader Colonel E. Wood.[1] N/5 after the Kafir War passed on into a much more serious campaign—the Zulu War of 1879. I have in Part I dealt with their services in that campaign, and will therefore only mention now that Capt. A. M. Vibart (3205) succeeded Stuart Smith, the subalterns in 1879 being Curling, Parsons, W. J. Fowler (3250), H. M. L. Rundle (3712) and E. H. Hare (3766) in succession.

The battery served in the Boer War of 1880-2 and on November 13th 1880 the H.Q. were at Pretoria, with four guns, of which two accompanied the field force to Potchefstrom under Major C. Thornhill (2606) and Lieut. Leslie Rundle (3712) who here laid the foundation of his subsequent distinguished career. Meantime Lieuts. Curling and Fowler had both been promoted in August 1879, and the former fell to G/3 at Kabul and served in the Afghan campaign of 1880.

In 1882 the title of the battery was changed to N/4; in 1884, 1889 and 1895 to Depot, 2nd Bde., 2/1 Depot, and 86th Battery respectively. It remains 86th, and as a howitzer battery it took

[1] The famous Field-Marshal.

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part in the South African War of 1901-2. In 1901 it was attached to the Corps Artillery of the 5th Division Natal Army (Buller) in the De Wet operations, two guns being with Pilcher's column of General C. Knox's force.

In 1902 we find it serving as R.A. Mounted Rifles—a new rôle for the Regiment, which it ably filled—and was in the 12th Bde. Division of Colonel J. Dunlop's column.

The battery had a distinguished record during the whole of the Great War, 1914-18. It went out with the VI Division and first came into action on 17th September 1914 on the Aisne. Its subsequent honours were Armentières, 1914; Ypres, 1915 (Bellewaarde); Somme, 1916 (Albert, Morval, Le Transloy); Arras, 1917 (Scarpe I & II, Arleux); Ypres, 1917 (Ménin Road, Polygon Wood, Broodseinde, Poelcapelle, Passchendaele I & II); Somme, 1918 (Bapaume); Arras, 1918, Scarpe, 1918 (Drocourt, Quéant, Hindenburg Line); Cambrai, 1918 (Selle, Valenciennes, Sambre).

The 86th (How.) Battery is now serving in India at Trimulgherry with the XVI Brigade. The Commanding Officer is Major J. Scott, D.S.O., and it is due for home 1932-3.

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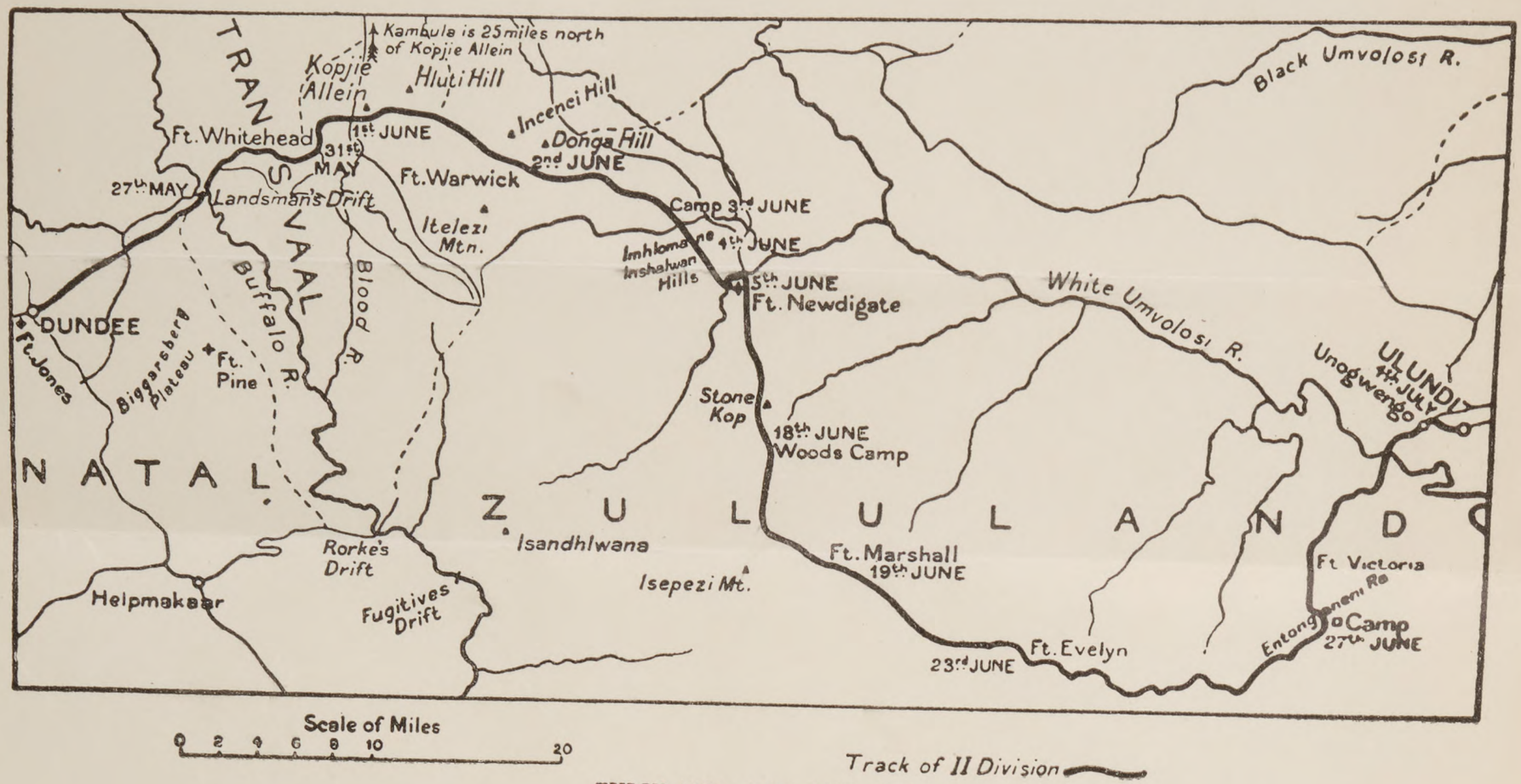

ZULULAND, 1878 AND 1879.

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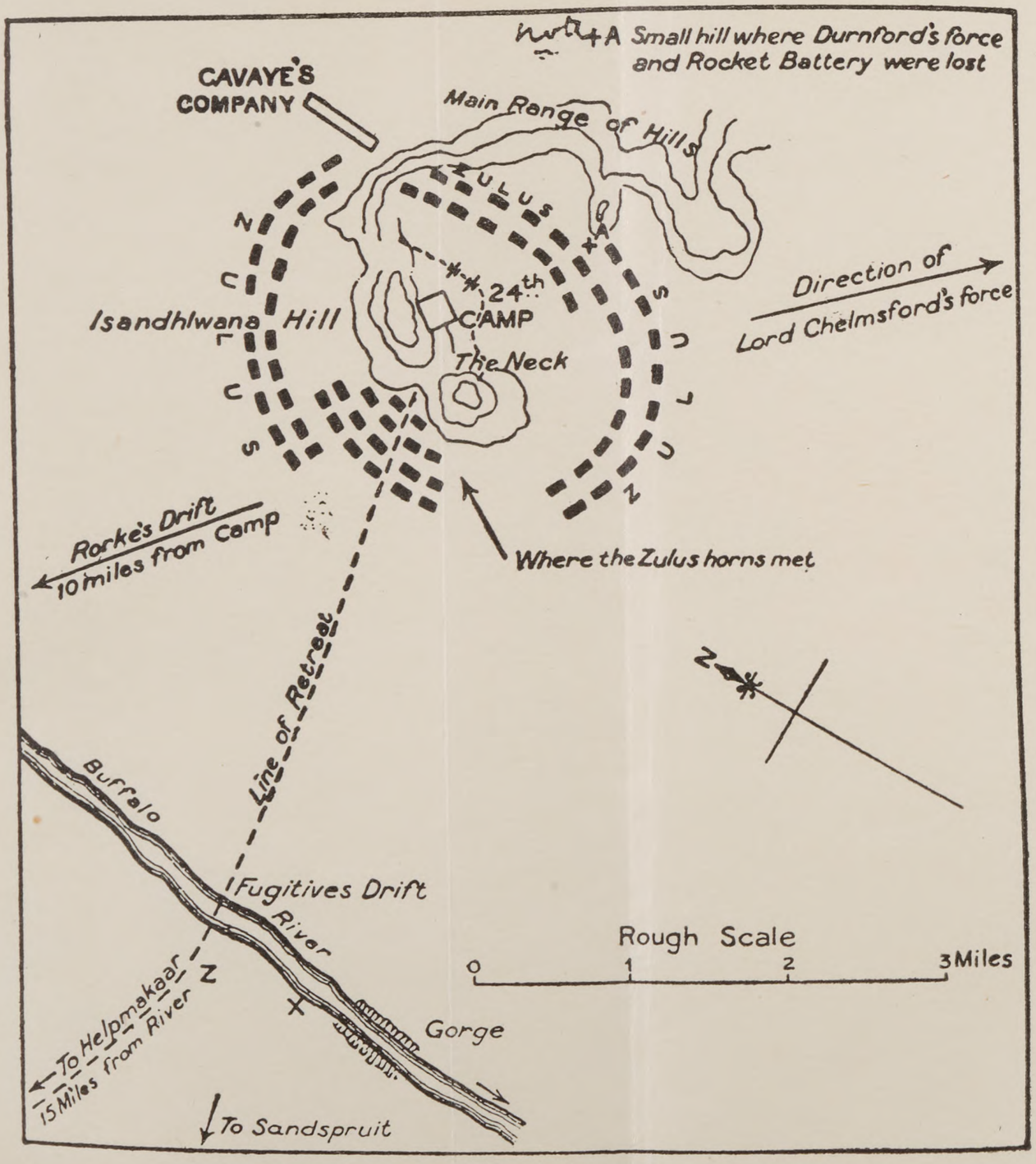

ISANDHLWANA, 22ND JANUARY, 1879.

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GROWTH OF ARTILLERY TRAINING.

By Major C. A. L. Brownlow, D.S.O., R.A.

IT is understood that a new edition of Artillery Training Volume II is to be issued shortly and that the present provisional Volume III is under revision. On such occasions there are few who do not remark, in varying degrees of propriety, on our habit of turning out new training manuals. And of the remarks so offered the most difficult to answer is that of the mess cynic who asked—"As our many regulations on training for war professedly deal with principles and as the principles of war, according to these regulations, do not change, why then do the volumes change?"

It is not the object of this paper to answer so profound a question nor to make comment on the new publications; but this subject did arouse the writer's curiosity as to the lineage of our present-day Artillery Training and caused him to search into the past. The object then is here to set down the result of this quest and to trace, briefly and lightly, the changes and growth of the official instructions for the training of the Royal Regiment of Artillery.

To grub about in musty and obsolete drill books may seem, at first sight, a task both profitless and tedious, but it did not prove so; and if, in these pages, the reader may find matter of interest and sometimes of amusement, then they will not have been written in vain. 1860 is taken as the starting point—in this year the first of the Manuals of Artillery Exercises was published embodying various old regulations and, presumably, lessons learnt in the Crimea and Indian Mutiny. The Manuals of Exercise continued until the year 1889 when they changed in form and scope and a new title was given, namely "Field Artillery Drill." In 1902, after the South African War, "Training" replaced "Drill." In 1902, in 1920 the word "Field" was dropped.

The following is a list of the various publications—the numberless amendments which poured forth in the intervening years have not been mentioned.

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1860. Manual of Artillery Exercises.
1861. Manual of Field Artillery Exercises.
1867. Manual of Artillery Exercises.
1870. do. do. do.
1873. do. do. do.
1875. Manual of Field Artillery Exercises.
1877. do. do. do. do.
1881. do. do. do. do.
1889. Field Artillery Drill. (Note.—This edition was in three vols.)
1893. do. do. do. (Note.—This edition returned to one vol.)
1896. do. do. do.
1902. Field Artillery Training.
1902. do. do. do. (Note.—Complete revised edition.)
1906. do. do. do.
1908. do. do. do.
1912. do. do. do. (Provisional.)
1914. do. do. do.
1920. Artillery Training. (Provisional Vols. I, II.)
1921. do. do. (Provisional Vol. III.)
1923. do. do. Vol. II.
1924. do. do. Vol. I.

In the above list and in this article only those publications that affect field artillery have been considered. It will be seen that in a period of sixty-eight years (1860-1927) twenty different publications have appeared; that is to say an average of one every four years. Therefore, it is a fair estimate to state that new editions may be expected about 1928 and 1932. Commencing with the Manual of 1860, the various books will be considered and such detail as is thought to be of general interest touched upon. The table accompanying this article shows comparatively the contents of these publications between 1889 and 1914.

Manuals of Artillery Exercises, 1860-61.

The manuals are not pocket books but well developed volumes with gilt edged leaves and stout red covers, gold tooled and bearing

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the Royal Arms. They issue from the Horse Guards "by Command of His Royal Highness the General Commanding in Chief" who directs that "every officer of the Royal Artillery shall provide himself with a copy." The Manual of Artillery Exercises, 1860, deals with gun drill and equipment, the greater part concerns what is termed "The Service of Heavy Ordnance," wherein much is said of gyns and crab capstans, levers and handspikes, pointing, laying and hot shot drill. The beginning of the book contains instructions on field gun drill. There is mention here of "Light and Medium Artillery"—new words in old settings or rather old words which have adopted new guises. In a preliminary paragraph it is stated "long verbal explanations relative to the disposition of every part of the body and limbs which drill serjeants usually recite relative to every motion are for the most part a loss of time"—so the repetitious drill sergeant has been a source of trouble through the ages and, probably, ever will be.

In the drill of the detachment there is clearly traceable a family likeness to our present gun drill. A gun is served by a detachment of which "No. 1 commands and lays : 2 spunges : 3 loads : 4 serves the vent : 5 fires and 6 serves ammunition." Further "At the word 'prepare to mount' the numbers run to their places—lay hold of the guard irons, etc., etc., and at the word 'mount' the whole spring into their places lifting their feet close together and throwing them over the guard irons." Surely there is something rather fascinating in the thought that though the Royal Artillery has passed through many years and many wars since this was written and has seen many a change take place in its equipment, organisation and training, yet still "No. 1 commands" and still "the detachment spring into their places, throwing their feet over the guard irons." Here, too, is to be found the hardy old pictures on knotting and lashing with descriptions much as we have them to-day.

A table of official ordnance, "authorized by the Secretary of State for War" reveals a formidable array of weapons—guns, howitzers, mortars and carronades made of iron and of brass, some smooth bore, some rifled, the majority muzzle loaders but with new breech loading guns a feature of progress. Moreover, all these weapons were of all calibres, lengths and weights and the different kinds of ordnance given in the Table total up to nearly eighty, and

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as each nature of equipment, apparently, had a separate drill the variations in gun drill must have been formidable.

The Manual of Field Artillery Exercises, 1861, contains instructions for field and horse artillery as to equitation, driving and drill movements both mounted and dismounted. The equitation calls for little comment—the aids differ somewhat but the orders for drilling a ride are much the same as to-day. As regards jumping, however, which is officially termed "leaping," the instructions are very brief and terse. The nomenclature of artillery organisation differed from that of to-day. The "sub-section" was called "sub-division," the "section" was "division" and the "brigade" was not a fixed organisation but a temporary grouping of batteries. The battery was commanded by a first captain under whom was a second captain. The greater part of the manual is devoted to battery and brigade mounted drill, termed "manœuvres." This drill is amazingly complex; for a battery there are fifty-seven various and different evolutions and for a brigade forty-four and, in addition, mounted ceremonial drill. All manœuvres were prefaced by the order "off gloves, loop swords." As swords were carried on the person when mounted, the reason for this order is clear, but why gloves were removed is not so obvious, perhaps the pipeclay made the holding of reins impossible at movements faster than a walk.

Of the type of movements the following are examples :—"From line to retire from the centre in double column of sub-divisions." "To move to a flank in prolongation of an alignment in column of divisions." "To wheel in oblique echelon of sub-divisions to the right."

Following on the chapter on manœuvres, comes one on "encamping and picketing." In those days encamping was far removed from the free and easy method of to-day where an advanced party pitches the camp some days ahead in a leisurely and none too accurate manner. Encamping was reduced to a drill in order to ensure "regularity and expedition." All ranks were assigned definite duties. In the words of the book—"odd numbers carry tent poles, even numbers picket posts." After many preparatory movements "the whole stand ready till the word is given to 'encamp and picket.' " Then comes the grand finale of "prepare to raise

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tents"—"raise tents," when row upon row of white bell tents snap to attention, all beautifully white, taut and dressed; a sight most pleasing to the military eye. At the end of the manual is a chapter on the Armstrong gun, a rifled breechloader firing a lead coated shell. It had just been introduced into the service and was still an experimental equipment and not in general use. One can imagine the warriors of the Crimea, pulling their whiskers and, over their cigars and brandy, heartily condemning an innovation so unpractical and complicated.

On gunnery and tactics little is said. All that is given in this respect is contained in a few sub-paragraphs in some preliminary observations on drill and manœuvre. They may be quoted in extenso. "Artillery, without being obliged to follow step by step the manœuvres of cavalry and infantry, proceeds to the execution of orders it receives in the easiest and most expeditious manner." "As a general rule the guns of a battery in action should not be discharged at once but a continuous fire kept up and they should be directed on some named object. The guns are not to be loaded until the word 'load' is given by the commanding officer and when loaded are not to be fired without orders. The attention of officers in action should be principally directed to the effect of the fire of the guns so that they may be able to direct any alteration required in the elevation or laying."

There is an extract from "Field Exercises and Evolutions of Infantry" showing the extent of the tactical co-operation between arms—it runs: "The usual position of a battery of artillery is on the right with an interval of 22½ yards . . . . when squares are formed in echelon and the battery is brought into action, the muzzles of the guns should be in line with the rear base of the rear square." The law of compensation is always at work, and whatever profound study and weary hours the subaltern of 1860 spent on drill and manœuvre, gunnery and tactics cannot have made great inroads on his leisure or his brain.

Manual of Field Artillery Exercises, 1881.

Let us now pass on twenty years to the manual of 1881, the last of the series. By this year much water had flowed beneath the military bridges. Major wars had shaken the Old and New

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Worlds and their lessons had taught much to the British Army. In addition England had had her own small wars and the threat of another conflict with Russia had forced a close inspection of her armoury both at home and in India. These changes are evidenced in the pages of the manual of 1881 where definite instructions are given as to gunnery and the employment of artillery in the field. Still, much remains of the old overpowering drill and manœuvre.

The nomenclature of the various units of organisation are unaltered but a new one is added in the term "brigade division," meaning two or three batteries grouped under one command; first captain has disappeared by now and major is the established rank for the command of a battery. The chapters on equitation and drill are the same in essence though differently arranged. Horses still "leap" and gunners are taught to march by plummet and pace stick. The official requirements as to a gunner's body on the march are worth noting. "His arms and hands must be kept steady by his side, care being taken that the hand does not partake of the movement of the leg. The movement of the leg must spring from the haunch. Both knees must be kept straight to the front and the feet, without being drawn back, must be placed softly on the ground, the toes turned out at the same angle as when halted." The Horse Guards knew better than Man's Maker how man should walk.

In the mounted drill signals by arm are introduced for the first time, many being the same as we know them to-day. The progressive parts of the book are the chapters on gunnery and the employment of artillery in the field. As one reads of ordnance, charges and projectiles and of the forces acting on the projectile within the bore and during flight, the following paragraph, boldly headed, is encountered:—

"Muzzle or Breech Loader."

"Muzzle loading guns have been adopted in our service on account of their greater simplicity, a quality which is held to outweigh the advantages claimed for the breech-loader."

One meets, too, a short paragraph which must be the first official instructions ever published on ranging. It runs as follows: "It is advisable, when circumstances permit, to ascertain the elevation by a fire of common shell with percussion fuzes. Begin with

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elevation for the estimated range. If the shell falls short (or over) increase (or reduce) the elevation by 100 yards till a shell falls over (or under). Then reduce (or increase) the last elevation by 50 yards and fire a few rounds. If half the number of rounds fired with any given elevation fall short it shows that the M.P.I. is at the foot of the target." A note in parenthesis states that the above system is based on German practice regulations.

In another part of the book where the duties in action are given the following complementary instructions on ranging appear: "On all occasions on coming into action the commanding officer of a battery will order the number of yards range for which the sights are to be adjusted and no gun is to be fired without being carefully laid on some definite object. The first few rounds must be trial shots and should be slowly fired and carefully watched." At the end of the book is a description of a new instrument called a "rangefinder." There is a strict injunction that "the introduction of the rangefinder is not intended to supersede the practice of judging distances." The chapter on the employment of artillery in the field opens with the remarks on the higher organisation of the artillery into corps and divisional formations and of the function of their commanders. It is stated that the divisional artillery commander not only commands but also "forms an integral part of the divisional staff," and he is enjoined "to encamp with the divisional general and to beware of his intentions so that the artillery can act accordingly."

The chief principles of the employment of artillery are laid down as:—

(a) Concentration of batteries and fire under one command against one objective.

(b) Direction of fire against the principal objective of the moment.

(c) Early deployment of all the artillery.

As regards (a) it is said: "The full power of artillery can never be attained unless the guns are directed in large numbers under the impulse of one command so as to bring a particular portion of the enemy's force under the heaviest possible fire at a given moment." As regards (b): "At each stage of the action one arm is for the moment principal . . . . as a general rule artillery should fire at

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that arm of the enemy." The artillery of a force is to march well forward in the advancing columns, to deploy early in mass and, occupying open positions, to engage "the principal arm of the moment," or in other words first to engage in an artillery duel and then, when the infantry have formed up and advance, to turn fire onto the enemy infantry.

Except for skirmishers, the artillery advances quite unprotected, it being considered that guns can protect their own front with their own fire. In the final stages when the infantry are about to assault, a portion of the artillery is pushed close in to the enemy on one of the flanks of the attack. Fire directed over the infantry is not considered.

Field Artillery Drill, 1889.

The next publication, produced in 1889, in outward appearance at any rate, is very different to the Manual of Exercise. It is now called Field Artillery Drill and, in size, has shrunk to the pocket book form with which we are familiar to-day. The cover is in red leather and the title and Royal Arms are gilt stamped upon it—an effective and natty presentation of instructions for soldiers who operated in uniforms of blue and gold. As for the change in size, one can visualise the deep consultations and brilliant imaginings which foresaw the future drill books reposing in the pockets of officers and other ranks to be pulled out and consulted as occasion demanded. Yet, one is forced to ask, who has ever seen either in peace or war a drill book produced from a soldier's pocket? And to carry the drill book of 1889 required a number of pockets for it ran into three volumes, a system not to be again repeated until after the Great War.

The chapters run serially through the three volumes, the first of which deals with equitation, movements on foot and driving. There is little to remark on here, for the matter, though differing slightly in detail and arrangement is much the same as the corresponding chapters in the Manual of Exercise of 1881. Volume II covers gun drill, gunnery, the employment of artillery in the field and certain miscellaneous items. Here there is much that is new and enlarged and, it may be said that the two chapters on gunnery and the employment of artillery are the Adam and Eve of Artillery

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Training, Vols. II and III, of to-day. It is rather interesting to note how bits of the old have survived to the present, passed down like hereditary traits from edition to revised edition. For instance, the explanation on gravity which appears on page 8 of Artillery Training, Vol. II, 1923, and on page 9 of the Field Artillery Drill, Vol. II, 1889, begins with the same sentence and is illustrated with the same diagram.

In the 1889 edition the chapter on theoretical gunnery is divided into lectures, a system which was continued for many years. By this date breechloading guns had been definitely introduced into the service and the field artillery was armed with the 12 pr. B.L. gun as well as with the old R.M.L. equipments. It is not without amusement that one reads the consequent alteration to the paragraph on the relative merits of breechloader and muzzleloader which has already been quoted. The new paragraph runs as follows: "The large charges required by modern guns in order to attain high velocity have rendered longer guns and larger powder chambers necessary. It is very generally admitted that it is easier to carry these conditions out with B.L. than with M.L. guns. On the other hand, so far as the gun alone is concerned, the M.L. is undoubtedly simpler." Undoubtedly, Oh military diehard! But, even in the Army there is progress in spite of your restraining influence and the muzzle loader is doomed to go, as also black powder, whiskers and shabraque, to give place to the breechloader, to cordite, to khaki and the big moustache.

Detailed descriptions of the matériel in use are given. This data includes range table performances. Extracts from these as affecting the 12 pr. B.L. and 13 pr. R.M.L. are here set out and, when one considers that the propellant used was black powder, these facts are rather surprising.

12 PR. B.L. M.V. 1730 F.S.

Range.	50 % zone L	50 % zone B	Elevation.	Remaining Velocity.	Time of Flight.
2000	21	1·18	2° 38′	993	4·75 secs.
3000	25	2·12	4° 51′	856	8·05 ,,
6000	not given		15° 30′	585	20·61 ,,

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13 PR. R.M.L. M.V. 1560 F.S.

Range.	50 % zone. L	B	Elevation.	Remaining Velocity.	Time of Flight.
2000	23·25	1·44	3° 6′	974	5·3 secs.
3000	31·95	1·92	5° 47′	862	8·78 ,,
6000	57·4	3·15	19° 57′	639	23·7 ,,

In the chapter on laying appear the first instructions on indirect laying; here is the germ that developed into our present procedure for shooting from under cover positions; here too appears for the first time the word aiming point. The chief instrument for firing indirect was a fitting one—namely the sword—the instructions are worth quoting. The line of fire is obtained thus: "No. 1 retires to a naturally or artificially raised position—as far back as convenient—from which he can see both object and gun and directs a sword to be placed in line with the rammer, held vertically over the gun, and the object . . . . The gun has thus been laid for line, the elevation is given by clinometer. An aiming point should next be established. If there is no natural object which will conveniently serve, a sword handle should be made as an aiming point."

Following on laying comes "Instruction in Shooting" which opens with a sentence apposite to gunners for all time, a sentence that might well be enscrolled in gold above the entrance to the School of Artillery. It runs: "To shoot well is the chief attainment of artillery; all other training is to be used as leading up to this supreme qualification. In the hour of trial no other standard of excellence will redeem a battery or any artillery force from insignificance." Somehow the imagination sees the mind that phrased those words as one in revolt against the dominance of accurate drill and everlasting polish, against the inverted foolishness of custom and prejudice which, in the military world, so often makes the means to an end of more importance than the end itself.

Certain rules are given for the conduct of the annual gun practice which is classed into "elementary" and "service." It is interesting to note that the B.C.A. of to-day was in existence then: "A N.C.O. specially trained in noting the effect of fire should invariably remain with the commanding officer, his sole duty will be to assist the commanding officer in observing." The process of ranging is more fully described and more definitely stated than in

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the manual of 1881. The term bracket is employed for the first time. The opening bracket is laid down as 200 or 400 yards which is worked down to 50 yards when groups of three rounds are fired until one such group produces both plus and minus rounds.

Among the duties of the officer shooting a battery we read: "The officer who directs the fire of a battery will remain mounted or will dismount according as he may best discharge his duties at the moment. He can command best mounted but close observation of fire is better attended to dismounted. He should be close enough to allow his orders to be heard clearly in the battery." Methods of fire are termed "succession of fire" in which all guns are fired in succession from a named flank. There are three rates of fire, namely, ordinary, slow and rapid.

While the chapter on the employment of artillery in the field is re-written and re-arranged yet in substance it is much the same as that given in the manual of 1881. Certain new paragraphs bring out the importance of co-operation with the infantry, though that word is not used. "The officer commanding the artillery of a force in the field whether his command be the artillery of an army or a single battery attached to an infantry brigade must remember that his main duty is to give the greatest possible aid, in every respect, to the other arms which are working with him, and should endeavour to carry out the general plan of action proposed by the officer commanding the troops." "It is obvious that it is very important that the officer commanding the artillery should be in the confidence of the general; the former must, therefore, be most careful to avoid all friction with the other arms and should endeavour to make himself personally welcome to the staff. Verbal instructions, given in the course of conversation are of more value than any orders in assisting him to carry out the wishes of his superior officer." "He must be careful not to act as though the engagement were to be decided by artillery alone with the infantry as escort."

The third volume of the 1889 drill book begins with a detailed description of the equipment carried on man, horse and vehicle. Knapsack is still an official word and one also finds that the service kit of officers includes silk pocket handkerchiefs, journal books and nightcaps. But the major portion of this volume is taken up by

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the instructions for mounted drill and manœuvre. The term "section" has now come into force, displacing the old "division" but "sub-division" still remains. The number of different battery drill movements has been slightly reduced to forty-two but the order "off gloves, loop swords" still presages all mounted movements. The passage of eight years has shown an advance in that it is now laid down officially where the removed gloves shall be placed, those of the drivers being put in the off wallets and those of the gunners underneath the blanket straps.

Field Artillery Drill, 1893.

This was the last artillery drill book to be introduced into the military world by a regimental order, issued from the Horse Guards by command of H.R.H. the Commander-in-Chief. Even now there is something rather melancholy in the thought that the Royal Duke who had been in chief command of the Army since 1856 would never again enjoin "that every officer of the Royal Artillery shall provide himself with a copy." Instead of three volumes there is now but one. The great idea of 1889 had not lasted very long. It is not hard to picture the scene which must have occurred in some dim room of the old War Office in Pall Mall where venerable military heads came to the conclusion that the drill book was too prolix and voluminous and must be cut down in the sacred cause of efficiency. The paring process was largely facilitated by the brilliant stroke of referring to the drill books of other arms. Thus a note at the beginning tells the seeker after military knowledge that he must turn to Cavalry Drill for equitation, foot drill and sword exercises, and to Musketry Regulations for carbine exercises.

There is a further difference from the 1889 edition in that the order of the chapters has been altered and ceremonial drill has been allotted a compartment to itself. In the definitions of gunnery terms, "angle of sight" walks on the stage for the first time and makes its bow to a puzzled audience. It will be remembered that annual practice was divided into "elementary" and "service"; now a third division is given, namely "competitive practice." Here is the genesis of the vexed question of competition at practice camps.

There follows a paragraph entitled "Criticisms of Practice," an extract from which runs: "care must be taken that full value is

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obtained from practice by submitting the conduct of the batteries and the report of the practice to the most searching criticism which should take place as soon as possible after each day's practice is concluded, in the presence of all who might derive benefit therefrom." What other words could better conjure up memories of practice pow-wows. In this volume certain new words are introduced: "fire tactics" or the selection of the right targets—"fire discipline" or the qualities which enable a battery to engage a target in the best manner and the quickest time—"ranging" which replaces the old phrase "finding the range by trial shots"—"long" and "short" bracket and "verifying series."

Field Artillery Drill, 1896.

This edition is of peculiar interest in that it was the last book to appear before the Boer War of 1899-1902. According to its teaching the batteries that fought in South Africa were trained. The first point of note is that the order in which chapters are arranged has again been changed, a sure sign of progress in military instruction. That on the employment of artillery in the field is now placed first, having gradually risen to this eminence through the succeeding years since 1881, though, as will be seen, it did not hold this pride of place very long. The principles laid down for the employment of artillery in war remain unchanged. The artillery of a force is placed well to the front on a line of march; batteries are deployed and advance before the other arms: "batteries should be brought up at the beginning of the engagement before the deployment of the other arms"; open positions are occupied and, in order to ensure control, guns are massed in action; fire is concentrated on the principal objective which is first the enemy guns and then the enemy infantry. The use of indirect fire is considered but is looked upon as a special procedure for abnormal situations. Similarly fire, directed over the heads of infantry, is treated as something out of the normal.

Though the power of artillery had increased enormously since the days of Waterloo, its tactical employment had changed but little. This was due to failure to realise the tactical effect of smokeless powder which, on the one hand, rendered concealment possible

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for guns, and, on the other, made the location of the enemy infantry a matter of supreme difficulty. Consequently technical procedure and artillery communications were not developed and controlled fire of guns in covered positions was not possible. The deployment of guns in front of the infantry in the opening stage of a fight was based on the assumption that "once in action artillery can protect its own front with fire," but a warning was given that "it will not be advisable to advance within long range (1500 yards) of the enemy's infantry." But the point, the vital point, was not grasped that with the new smokeless powder it would not be easy for the artillery to know where the enemy infantry were located and that guns pushed ahead at the commencement of a battle might blunder into the opposing infantry with disastrous results. This is exactly what happened to Long's Brigade Division at Colenso; that disaster was due not to the wrong leading of the commander but to the wrong teaching of the drill book. What seems to us now as a preposterous action on the part of the gunners becomes a perfectly clear and normal procedure if we study the principles of their tactical conduct.

In the chapter on gunnery the term "succession of fire" has been replaced by "methods of fire," which are given as "sub-division fire," "section fire," "battery fire" and "salvo fire." We begin to tread on familiar ground. The long bracket is laid down as 100, 200 or 400 yards and the short bracket as 50 yards. The verifying series is still part of the procedure of ranging. Instructions as to the conduct of the annual practice has disappeared and nothing is mentioned about "searching criticism," though no doubt it was acutely present. But the old paragraph on the relative merits of muzzle and breechloader still remains and the diehard still stoutly avers that "the M.L. is undoubtedly simpler than the B.L." As regards mounted drill and manœuvre, the movements of a battery have been greatly simplified and, in the main, are as we know them to-day. Aiming posts have now taken the place of the sword as a means of indicating the line of fire when firing indirect. There is no means of measuring the angle of sight apart from the clinometer on the gun, so that shooting from behind cover must have been a sketchy business.

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Field Artillery Training, 1902.

The next book appeared in 1902, the year that saw the end of the Boer War. The title is changed and "drill" gives place to "training." The first edition was quickly followed in the same year by a completely amended work; a very masterpiece of amendment which has not been equalled even since the Great War. The former is covered in the old red leather binding with the Royal Arms in gold; never again was this garment to be used. The amended edition has a cover of buff paper, reminiscent of khaki and stowasser leggings, redolent of reform, efficiency and post war economy.

The amended edition only needs consideration. In the main it adheres to the arrangement of the drill book of 1896, but the lessons learnt in South Africa are embodied. A prefatory note warns officers that, while the details of drill and manœuvre must be adhered to, the book must be taken as a guide and officers must rely on their own judgment and initiative to meet the ever changing circumstances of war. Here at the very outset is a lesson from South Africa for it will be remembered that strong criticism was levelled at our army as being too rigid and stereotyped in its training and lacking adaptability. This warning does not appear in later manuals but few will deny that it was a just one, and some may think it still applicable and worth taking to heart to-day with our passion for detailing the smallest actions of units and commanders.

In the sections on the general principles of the employment of artillery in the field, the new line of thought is at once met. While concentration of fire is still the first principle and the massing of guns to attain this still necessary in certain cases, yet the following qualification is added : "On the other hand owing to the great extent of front likely to be occupied by modern armies and the necessity of combining wide turning movements against the enemy's flanks, it will frequently be necessary to disperse the artillery." "Too much importance cannot be assigned to the concealment of guns, not only when in action but when advancing into action." Although the idea of co-operation with the other arms had long been formulated, the actual word "co-operate" is now used for the first time and the artillery commander is enjoined to accompany the force commander on his

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reconnaissance and be thoroughly acquainted with the plan of action. It is interesting to note that the firing of artillery over the heads of the infantry is now considered a normal procedure. Fire is continued until the attacking infantry are within six hundred yards of the target, when the elevation is increased and fire is directed on the enemy supports and reserves.

Partly in the chapter on gunnery and partly in the chapter entitled "Fire Discipline" are laid down the instructions as to the new method of firing from behind cover. The angle of sight can now be measured by instruments separate from the gun. Director and plotter appear on the scene and for the first time the triangle TOB is imprinted on the pages of Artillery Training. The new system is in its main lines much the same as that in use to-day; its introduction produced in certain circles a panic similar to that created by survey after the Great War. It is on record that directors and plotters suffered physical violence at the hands of majors of experience and repute; but the record is not official.

The major commands by voice, and if this is not possible one reads that "When the target can only be seen from a position too distant for the battery commander both to observe and command his battery an observing party must be detailed." The distant O.P. communicates by flag and the first artillery code is introduced: "The observing party will report the result of each round as if seen from the battery, using the following simple code—one flag overhead and one towards the target will signify 'over,' etc." In ranging, the terms "long" and "short" bracket have disappeared. Ranging is carried out by a section and when the hundred yards bracket is found, a few verifying rounds are fired at the mean elevation. Fuzes are still found by firing a ladder and the actual fuze lengths are ordered. In the chapter on manœuvre the only point worth notice is a change in nomenclature. The term "brigade division" has been cut down to "brigade" and "sub-section" has taken the place of "sub-division."

Field Artillery Training, 1906.

The next training Manual was published in 1906, bound in the red cloth cover of to-day and issued by the General Staff by command of the Army Council, words which spell the great reorganisa-

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tion that so radically changed the staff and control of the army. This was the first manual to deal with the new Q.F. equipments with which the artillery had been rearmed. As will be seen by reference to the table, the arrangement of the book has again been altered. The chapter on the tactical employment of artillery which in 1896 had been brought to the forefront is now relegated to a later chapter and the individual training of the man is once more the opening theme. For the first and last time that horrible word "goniometric sight" is used and there comes into being the word "corrector."

In the process of ranging as here laid down the verifying series at last disappears and is replaced by the hundred yard bracket being repeated. A special new section is given on "parallelism" and a new host of troubles darkens the horizon. Signalling methods are elaborated; special attention being paid to semaphore. The telephone is not yet in use but a footnote runs as follows: "experiments are being made with a view to employing telephones but no decision has yet been arrived at." Three pages are devoted to ranging with time shrapnel, a new gim, the latest big idea of the gunnery experts. Special reference is made, for the first time, to heavy batteries and instructions are given for the control of fire by cross observation. Now also appear the terms "battery zones," "allotment of tasks," "positions of readiness" and "positions of observation."

In the chapter on the "employment and conduct of artillery in the field" the new ideas introduced in 1902 have been elaborated. Under cover positions and dispersion are now the normal and this has made communications a matter of special importance. Communication is by flag and orderlies, and particular instructions are given for the training of the latter. Co-operation between infantry and artillery is strongly insisted on. "The closest co-operation between guns and the infantry firing line is essential. Communication between infantry and artillery commanders is of great importance and should be arranged when circumstances permit." Nothing is mentioned as to the juxtaposition of the respective H.Q. of infantry and artillery commanders. The importance of artillery reconnaissance is impressed. There is also a most useful section on the training of observers, an art to which more attention might, perhaps, be paid to-day.

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Field Artillery Training, 1908.

As this does not differ very greatly from the previous edition of 1906, there is little to remark upon; but it is worth noting that the telephone is now a part of a battery's equipment. Also one is pleased to note that "goniometric sight" has been dropped for the simpler "dial sight."

Field Artillery Training, 1912 and 1914.

In 1912 a new provisional training appeared which was the herald of the 1914 edition, published in April of that year. The latter manual only will be considered. The book is much enlarged with chapters re-arranged and new ones added. Foot drill which had been ejected from the manual as far back as 1893 is again incorporated and the enquirer eagerly learns that when the soldier stood to attention in 1914, his feet were at an angle of forty-five degrees, his breathing was in no way restricted and "no part of his body was either drawn in or pushed out." Compare now the military attitude of the soldier of 1889. "The exact squareness of the shoulders and body to the front is the first and great principle . . . . the hips drawn back and the breast advanced," etc. Equitation, the training of the young horse, sword exercises, all again appear after an expulsion from the manual of fifteen years, but with this difference, horses now "jump" instead of "leaping." The big thought of 1893 whereby the drill book was cut down from three to one volume by referring to the manuals of other arms is in 1914 cancelled by the bigger conception of including as much as possible so that reference to the books of other arms is not necessary; but there is one exception, for the compilers of the 1914 Training turned out into a cold hard world the chapter on Ceremonial, a cruel act which was rectified after the Great War.

The chapters formerly devoted to "application of fire" and to "fire discipline" are absorbed into two new chapters entitled "brigade tactics" and "battery tactics." Also new chapters are added dealing with ammunition supply, communications, movements and quarters. A useful innovation is the printing in heavy type of those points to which special attention is directed.

The greatest change, however, occurs in the chapter "employment of artillery in war," the old term "in the field" having been

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dropped. It has been entirely re-written and little of the old remains. It is not possible within the restricted compass of this paper to do more than touch upon a few points; but to study again the tactical doctrine that guided the artillery just prior to the Great War is well worth the trouble. One is surprised by finding therein much that one is inclined to think of as post war teaching. The object of artillery fire is laid down as:—

"(1) Assisting the movements of its own infantry.

(2) Preventing the movements of the enemy's infantry."

Economy of force is emphasised. The minimum number of batteries only are to be deployed while the maximum number are to be retained in positions of observation and readiness. How radically this differs from the principles enunciated in the drill books of the eighties and nineties! Useless expenditure of ammunition is strongly deprecated. While central control by the C.R.A. of a division is advocated "it will generally be inadvisable to delegate the command of a portion of the artillery to subordinate commanders"—the difficulties of control under the new conditions and circumstances of war are recognised and it is realised that the decentralisation of command will be forced to take place: "in cases it will be advisable that the artillery and infantry be formed into groups." Great value is placed on personal interviews and on communication between infantry and artillery commanders, but responsibility for getting touch is upon the gunner.

It is interesting to note that the germ of the idea of the F.O.O. and of the barrage are both contained in this volume. "The establishment of advanced observation posts may, therefore, be necessary to watch the situation generally, to obtain information from infantry commanders and to report to the artillery commander concerned." "If these open spaces have been registered the advance of the infantry may be delayed and possibly prevented by establishing a belt of fire through which it must pass. This belt can be moved at will."

But perhaps the greatest interest centres on the new conditions and actions caused by aircraft. Some extracts will now be given to indicate the line of thought at this period relative to this modern development in war. "During the period of tactical reconnaissance

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which precedes the battle and in the battle itself the employment of aircraft may assist artillery . . . . as follows :—

(1) By the indication of concealed targets.

(2) By observation of fire."

"Although the employment of aircraft has modified complete concealment; to some extent, guns in action may escape observation from the air if they are carefully sited. Groups of wagons and horses are easily seen. Advantage should therefore be taken of woods, avenues of trees and other features to conceal the limbers, first line wagons and horses of artillery." "The advantages to be gained by moving batteries into position under cover of darkness have increased owing to the difficulty of evading observation by hostile aircraft." Communication between aeroplane and guns was normally by visual, wireless not being sufficiently developed. Signals were made by Very Lights, fired on a simple system. The clock code was not in use and the air observer first gave observations for line and then for range.

Artillery Training, 1920-21.

Moving now past the Great War one comes to the provisional editions of the new Artillery Training, 1920-21. Herein are contained those lessons learnt in the school of war at the foot of that stern master Reality. The title is altered by the dropping of the word "field" and the work has grown to three volumes as in the case of the first drill book in 1889. Volume I differs but little from the corresponding chapters in the 1914 edition except as regards the occupation of a position and the organisation of the battery staff, ceremonial is reinstated and also there re-appears a chapter on knotting and lashing after a long divorce since the nineties. The gunnery volume has been enlarged out of recognition and completely re-written, though the influence of the past can be traced. The most noteworthy innovations are the new procedure for shooting with air observation, predicted shooting and barrage fire and, in smaller matters, the use of a zero line and certain new terms such as "G.P.O." and "B.C.A." In the third volume on the employment of artillery in war, the old chapters of the 1914 edition have been expanded to sixteen chapters and appendices. New ideas, new words, new thoughts—the outcome of war experience—

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are introduced, to name a few, one finds harassing fire, barrage, counter preparation, smoke shell, gas shell, camouflage, tanks and tractor-drawn batteries. But even while so much is new, below one can see the foundation of 1914—many a section and paragraph of the pre-war training manual is reprinted unaltered or but little changed.

As the object of this article is not to discuss artillery tactics or gunnery but to trace the growth of the "Artillery Training" of to-day, it is not necessary to say more upon this or upon subsequent editions for their contents are familiar to all and, from the writer's point of view, their province too fresh with young verdure to risk penalties of trespass. So the end has been reached of this cruise through the drill books and training manuals of close on seventy years; and if so august a literature may have perhaps been treated with a certain degree of flippancy, such was a necessary jam to render palatable many hundred dusty pages and many hundred thousand desiccated words on war.

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Comparative table of artillery drill books and training manuals, 1889 to 1914.

Chapter.	Field Artillery Drill.			Field Artillery Training.			
	1889. (3 Vols.)	1893. (1 Vol.)	1896. (1 Vol.)	1902. (1 Vol.)	1906. (1 vol.)	1908. (1 Vol.)	1914. (1 Vol.)
Chapter I.	Equitation	Driving	Employment of artillery in the field	Employment of artillery in the field	Training on foot	Individual training	Principles of training.
Chapter II.	Foot drill	Gunnery	Driving	Driving	Training for mounted work and driving.	Individual training for mounted work	Dismounted drill
Chapter III.	Driving	Equipment	Gunnery	Gunnery	Gunnery	Gunnery	Equitation and driving
Chapter IV.	Gunnery	Employment of artillery in the field	Drill and manoeuvre.	Fire discipline and fire tactics	Laying	Laying	Gunnery
Chapter V.	Employment of artillery in the field	Brigade and battery manoeuvre	Miscellaneous	Drill and manoeuvre.	Drill	Drill	Laying
Chapter VI.	Miscellaneous	Miscellaneous	Ceremonial	Ceremonial	Application of fire.	Application of fire	Mounted drill
Chapter VII.	Equipment	Ceremonial	Equipment	Miscellaneous	Manoeuvre	Manoeuvre	Employment of artillery in war
Chapter VIII.	—	—	—	Equipment	Employment of artillery in the field	Employment of artillery in the field	Brigade tactics
Chapter IX.	—	—	—	—	Miscellaneous	Miscellaneous	Battery tactics
Chapter X.	—	—	—	—	Ceremonial	Ceremonial	Ammunition supply
Chapter XI.	—	—	—	—	—	Equipment	Field engineering
Chapter XII.	—	—	—	—	—	—	Reconnaisance and communications
Chapter XIII.	—	—	—	—	—	—	Movement and quarters

NOTE. Manuals of artillery exercises prior to 1889 and artillery training subsequent to 1914 have not been shown.

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COMMUNICATIONS AND CLOSE SUPPORT.

By Captain C. T. Beckett, M.C., R.A.

WE have already considered the problem of close support from four points of view—the divorce of mobile tank defence from static defence and close support of the infantry attack and the provision of a suitable weapon; the organisation of the divisional artillery to encourage the closest liaison, personal sympathy and unity of interest with the infantry of the component brigades; the technical question of the most suitable weapon to carry out the duties of close support and static tank defence; and finally the effect of ballistic limitations on the tactical handling of the close support artillery. There remains the nodal point of criticism; the problem of communications.

It has been laid down with authority "that every artillery is close support artillery. It is the duty of all artillery to support the infantry and to be in close support." Artillery Training, Volume III, 55, 2, says when defining close support artillery that it is "a battery or section charged with the close support of a battalion or other infantry unit whether under the orders of the infantry commander or not." This definition begs the question. What is close support?

I have ventured elsewhere to define close support as the protection of the intimate interests of the infantry and the attack of their immediate objectives. Now it is apparent that the relative closeness of the support afforded by different natures of artillery must vary considerably. The more delicate and minute attentions of the watchmaker require tools the refinements of whose purpose is only equalled by the accuracy of their manufacture; while amongst the many processes leading up to the ultimate assembly of the balance wheel and the jewel setting are heavier and heavier processes until we reach the forge where bars of steel pass through their first metamorphosis, beneath the blows of a gigantic hammer. All these tools, no matter what their weight or the refinement of their purpose may be, contribute in some degree to the consummation of the ultimate creation, but it is essentially to the watch-

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maker's tools that we instinctively turn when we consider the final achievement.

In the same way, when considering the success of the infantry offensive or the repulse of the hostile attack, while all artillery will be affording the closest support of which they are capable, from the point of view of the immediate infantry commander the closest support which he will experience will not be from the commander of the 9·2 howitzer battery observing from neighbouring church spires or from balloons, it will not be from the commander of the 6″ howitzer battery supporting the division, who is observing from the front of the neighbouring brigade, and who is engaged in an aeroplane shoot on a hostile battery 4000 yards from the battalion commander in question. It may be from the commander of the field battery situated, perhaps, somewhere in his battalion area that he will receive his support, but on the other hand it is quite possible that the battery will be engaged, if an attack is in progress, in firing a programme or, if it is a hostile attack which is proceeding, in putting down fire on certain preconcerted points. On the other hand, under the present doctrine of selecting an O.P. in close proximity to the battery position, it is very likely that he and the battalion commander will not be in the neighbourhood of one another at all. It is far more likely to be from the section commander of the light artillery in his immediate neighbourhood whose horizon is definitely limited by the instructions which he has received and by the limitations imposed upon him by his weapon, that he will receive his most intimate aid. It is to him that the battalion commander will turn for what he considers close support. It is from him that he is certain to get intimate and personal attention, and it is to him that he will indicate the hollow where the enemy infantry are assembling for the attack or the alleged location of the machine guns which are holding up his advance. The French draw a distinction between this intimate close support and the other less easily recognised but equally important form of close support which the larger natures of artillery afford. The expressions "accompagnement" and "appui direct" may perhaps best be translated as intimate support and direct support (using the word direct as omitting the intervention or supplication of the infantry commander) and thus provide a distinction within the terms of

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the ruling to which we have already referred. It is to the first of these forms of close support that my definition must apply.

Now the distinction between these two forms of support is firstly a question of degree. It is uneconomical, often even impracticable, and usually indefensible, to demand from the heavier natures of artillery the crushing of a minor centre of resistance or the repulse of a local assault. It is secondly a question of opportunity in which, as we have seen, the position of the observer, preconcerted programmes and the absence of intimate liaison play a part, but it is only too often the breakdown of other communications which binds the infantry commander to his light artillery, whose reaction to his wish will be more instantaneous and certain, owing to its proximity, and which estranges him from the field artillery whose control is remote and at the caprice of lengthy lines of communication, even though its aid when rendered may be of greater weight. This latter situation, a choice of sources of assistance, is actually more favourable than that which the doctrine of to-day appears to envisage, for we are taught that short telephone communications must be maintained, that O.P's must be close to the batteries, and that voice control is the ideal to seek.

When we consider the ballistic limitation of high velocity ordnance, in undulating, hilly or wooded country, which Colonel Pagezy so lucidly explains for the benefit of the French infantry officer; when we remember that crest clearance at both ends of the trajectory at ranges of less than 2000 yards is a problem of the gravest importance; when we recall the difficulty of distinguishing friend from foe at distances of 1,000 yards and of identifying hostile machine guns at a distance of 200 yards; when we consider that defensive positions are usually sited on the tops or slopes of geographical features, that a good field of fire presumes command, and that occasions will be rare when the ground in front of the infantry will be equally well observed from an eminence some 2000 yards further to the rear, we may surely question the truth and practical possibilities of the doctrine of adjacent O.P's and battery positions.

If there is added to the bare grassy undulations of the Judæan plains, the screen of East Anglian or Western European wooded and cultivated scenery the question rapidly answers itself with a

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denial. Such ideal defensive positions may be found where foothills screen access to mountains and such examples may be cited as in the Jordan Valley; on the left flank of the British position in Salonika looking up the Vardar Valley over the Ghevgheli plains; from the Turkish position on Achibaba overlooking the Toe of the Gallipoli Peninsula or from that artilleryman's paradise in Thrace, the Chatalja lines. These are all special cases and are examples of defensive positions of inviolable strength. In the more normal give and take of variable terrain to which the British Army is liable few such defensive opportunities occur.

Even the plains of Mesopotamia are broken by high canal banks which afford both cover from hostile artillery observation and the almost inevitable necessity, if close fire is to be brought to bear on their far side, for an O.P. remote from the battery. In other more civilised landscapes, such as the region of Tournai, East Anglia or our own training grounds, belts of trees, houses and undulations, both in attack and defence, screen the enemy positions—not to speak of such more invisible items as harassing machine guns, reserve concentrations and local attacks—from the inevitably remote battery position. This is the price which we pay for the physical and moral effect, for the stopping power of shrapnel, and for the deluge of fire which high velocity weapons afford.

Once we admit the inevitability of forward observation and distant telephonic control we are confronted with the problem of communications. One is compelled to wonder how many officers have not in their day, whether as battery commanders, captain or gun position officers seized the megaphone and addressed in withering terms the coverer or driver who in leaving the battery position has entangled his team in the battery telephone line. This is but a practice camp incident, but who is there who cannot recall lines cut in pieces by traffic of all kinds during the war, not only by wheeled traffic but by working parties, ration parties, parties carrying R.E. stores, enemy shell fire, deliberate brigandage by units short of wire and a thousand other causes. Let us add to these causes the advent of innumerable tracked, semi-tracked and six-wheeled vehicles glorying like waterspiders in their freedom of movement, and we are forced to admit that reliance upon telephone

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wire in the battle of the future is to mount our fate upon a cloud; and yet this is not the end of our troubles.

The wire with which our field artillery is equipped is too easily damaged, and the insulation too easily removed; quality has had to be sacrificed to weight, and still the quantity is limited. In the battle it will not be possible always to reel up, the advance will often take place towards evening and signallers cannot be abandoned to their own devices to reel up cable if the very real risk exists that neither signallers nor cable will rejoin for many hours and perhaps even days. After the battle of Beersheba in 1917, no signallers would have found the batteries of the 74th Division very readily, and during their absence the batteries might have been engaged and have urgently needed their services. In a retirement the wire is inevitably abandoned. As regards quantity it may be recalled that at the affair of Beit Ur el Fokka, owing to the broken nature of the ground and the intervention of several crests between the battery and the enemy position, over 7000 yards of communications were laid out though the range was about 3400 yards, and even then the observer did not actually attain by some yards the headquarters of the infantry commander with his telephone. To establish these communications took three hours. Limited observation was obtainable from an O.P. 1000 yards away in the meantime. Again at the the battle of Tel Asur the battery commanders, though observing from close to their batteries at the commencement of the battle, were soon compelled to go forward over broken country which necessitated much preparation before the batteries could close with them, at the end of lengthy communications which necessitated intermediate heliograph stations to eke out the paucity of wire.

In less rugged country less wire would have been necessary but on the other hand there would have been less chance of covered eminences from which to use the heliograph or other visual means of communication. In close country visual signalling over appreciable distances is usually impracticable. The difficulties of crest clearance are met, to a very limited extent owing to the paucity of their numbers, by the employment of howitzer batteries. But it is using a sledge hammer to crack a nut to use 4·5″ howitzer batteries for the most intimate form of close support. Nevertheless

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we may well have to consider their use at closer ranges than those to which we have been accustomed, and for targets more detailed than those which are considered their normal task, and in doing so we may well remember the use of the lower charges with which the howitzer is equipped.

When, at practice camp, a battery commander has placed his O.P. in close proximity to his battery position he is practising tactics which elsewhere only exceptional terrain or the conditions of a retirement can justify and he has permitted administrative convenience to obliterate the recollection of five years of varied conditions of warfare. To what then are we driven? From elsewhere than from the most advanced localities we cannot see. How can the field artillery provide close support? Are we to be relegated to the limitations of predicted shooting? Is it to this end that we seek longer and longer range, greater stability of platform, higher perfection of ballistic performance? Will the air always observe for us? and from which height and with what training and liaison? and in what numbers? How then are we to range the field artillery alongside the light artillery in providing the most intimate support? I submit that greater range without ground observation is practically worthless; that greater range without the means of liaison to use the increased mobility of the shell to the better performance of our close support duties, if we cannot be at the infantryman's side to deal, like the watchmaker, with the minutiæ of his troubles, is a blind alley of research. I submit that the field gun of to-day, provided with better means of combating tanks is adequate, and I submit that once we admit the inevitability of forward observation and the fallibility of our existing system of communications, the time and money and research which we now expend in bettering our ordnance and our carriages, fully aware that our stocks of ammunition and guns make any change a remote hope, would be laid out with far greater effect if we turned our thoughts to one subject; like Colonel Pagezy I will put it briefly:—

Radio Telephony.

Amongst human beings, persons whose nervous systems are incapable of controlling the motions and reactions of their limbs are termed epileptics, and when their nervous systems not only

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cease to control the limbs and the impulses but culminate in inexplicable and uncontrollable acts of violence, doing harm to other human beings, the subject is placed upon his trial and at best, if he does not hang, he is confined in an asylum for life. Such persons, if they are wise, consult an alienist in the early stages of their infirmity.

Our nervous system as a regiment is in danger. Impending epilepsy may result in homicidal outbreaks or may even degenerate into paralysis. Our two sister corps, our specialists, have prescribed for us. We must make the best use of the facilities which they have offered us. Real progress has been made. Let us make no mistake as to the intensity of their researches or the magnitude of their labours and let no one minimise the difficulties which beset their problems or the difficulties which have been overcome. Can we not find amongst our own younger officers, to whose generation wireless telegraphy and radio telephony are the commonplaces of everyday life, some who can, like the general practitioner, carry out intelligently and without factious criticism the treatment which has been prescribed, developing and modifying to our special needs the instruments provided for us? It is imperative that we take action lest we find ourselves relegated by those inexorable judges, Results and Finance, whose severity is only tempered by the merciful recommendations of the jury of tradition, to that rapidly-filling institution where other anachronisms are dragging out the twilight of their existence, fighting again on Beacon Hill the close support tactics of Waterloo and Colenso, and dwelling upon the successes of feudal chivalry at Halidon Hill, Marston Moor, Willems and Balaclava.

CONCLUSION.

We require firstly a definition of what we mean by close support, and we must decide whether we should not go further and say clearly what we mean by support under its two aspects, intimate support and direct support. We require a coherent doctrine based upon these definitions separating our demands for static defence and attack from mobile defence and attack; separating our infantry ground tactical problem from the problem of defence against, and the counter attack of, the tank. We must next consider our weapons for these purposes:—

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(a) for intimate support, for whatever the means of communication the psychological factor in the infantryman will demand a weapon close at hand;
(b) for anti-tank defence or for a combination of these two purposes;
(c) for mobile anti-tank defence and attack;
(d) for direct support;

and we must realise clearly the ballistic limitations of the problem in the case of each item.

We must next consider the organisation of our forces:—

(a) administratively, to attain the greatest social intimacy and tactical homogeneity, and to attain the greatest economy of force to provide for relief, rest, and a suitable reserve;
(b) tactically, so that we have a considered plan in depth which will utilise each weapon or unit to its best advantage.

We must revise our ideas of the organisation of the divisional artillery in the direction of reduction to permit of

(a) greater fluidity of resources;
(b) financial adjustment, if necessary, to admit of the introduction of a greater number of intimate support weapons.

Finally we must consider the all important question of communications. We must face the breakdown so far as the Royal Artillery is concerned and we must make up our minds that the situation is such that there are no drawbacks present in wireless to-day which are not overwhelmingly present under the existing system of line telephony. We can afford no longer to investigate this matter on the lines of academic research. Wireless is no longer the close preserve of the scientist, to whom perfection alone appeals. In such a matter of everyday life we need the widest possible trial by the ordinary user under everyday conditions. "Le mieux est l'ennemi du bon." Admitted the possible lack of secrecy. Line telephony is not itself immune. Admitted the possible breakdown of communication through jamming. Are we worse off than with our lines cut to pieces? Admitted the bulk of the apparatus when compared with the telephone, but do not forget the bulky reels of wire and the two linesmen that accompany them. Let us then construct without further delay the web which will bind our whole system of close support together:—

Radio Telephony.

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ARMY AND ROYAL AIR FORCE CO-OPERATION.

By Lieut. A. P. C. Hannay, m.c., 2/Battn. The Queen's Own Cameron Highlanders.

TWO articles that have appeared in previous numbers of the R.A. Journal, the first by Major Cherry, R.A., and the answer by Squadron Leader Slessor, R.A.F., should prove of great interest to almost any service reader, and both are obviously written with a view to producing the closer co-operation between the two services which is an essential to success in war. The writer of this small article would like to preface his remarks by saying that he is an officer, who for the past five years has been seconded from the Army to the R.A.F., and consequently has sincere affection for both services, naturally for his parent service and in no less a degree for the service who adopted, paid, fed and taught him for five years. He trusts, therefore, that his criticisms are as nearly unbiased as is humanly possibly.

It strikes one on reading the first article and then the answer that, despite their efforts to promote co-operation, the writers are in reality antagonistic, they both appear to be searching for the mote in each other's eye without noticing the beam in the eyes of the respective services which they represent. Compromise is almost the basis of existence—nothing is perfect—the nearest approach to perfection in everything is the best out of two or more subjects—articles—or any other subject. For the purpose of aiding clearness the article will be divided into the following headings and sub-headings :—

1. General discussion of views advocated by Major Cherry and Squadron Leader Slessor.
2. Outline of army co-operation duties.
3. The question and comparison of army co-operation personnel.
4. Suggested remedies.
5. Concluding discussion on
   (a) The staff officer observer.
   (b) Use of radio telephony.
   (c) Dress of seconded officers.
6. Summary.

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1. General discussion of views.

The R.A.F. is roughly divided into three main groups—The Fighter, The Bomber, and The Army Co-operation Group. Although the first two naturally affect the last named, it is chiefly with the last named that this article is intended to deal. The undercurrent that appears to influence Major Cherry's article is the hope of a rebirth of the Royal Flying Corps, an organisation under complete army control, and this is almost violently opposed by his answerer. There are many pros and cons to this subject which has been fully thrashed out—almost *ad nauseam*. But one would imagine that at this stage of the proceedings such an undertaking as that advocated by Major Cherry, could only be compared to that of changing horses in mid-stream—and a swift, deep and dangerous stream at that. In any case the matter has been definitely settled for us, so that even contemplation of it is merely futile. Therefore we must look for the eternal compromise—a compromise in which both parties must be long-sighted, candid, and imbued with a spirit of "give and take." Such a compromise is partially in existence this very day in the army co-operation group of the R.A.F., in the form of the seconded officer. This small band of "hopefuls" has been entirely ignored by one writer and merely received recognition in the form of a sound slapping like a naughty child, by the other. But perhaps this compromise in embryo can be examined from a common sense point of view to see if it can be improved, and if so, how?

2. Outline of army co-operation duties.

Taking it for granted that army co-operation is a necessary branch of aviation—and whatever anyone may say, a highly specialised branch at that—what is required of the army co-operation unit or individual? Firstly and chiefly observation in its many forms:—

1. Observation close to the line.
2. Observation at medium and far distances behind the line.
3. Observation by camera.
4. Observation for artillery.

Therefore, logically and primarily you require someone who knows what to look for—where reasonably to expect to find it—and having

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found it—how to give an accurate account of all he has seen. We can take it that to ensure anything approaching success the pilot and observer must almost invariably be one and the same person. Let us refer to him hereafter as the pilot-observer.

3. The question and comparison of army co-operation personnel.

Flying—as Squadron Leader Slessor has truly said—is no Black Art. But above all other type of pilot the army co-operation pilot-observer must be a "sure" flier. He has plenty to do in the air without having to be constantly attending to the flying of his machine. It should be done almost instinctively. Therefore in this respect the seconded officer and his brother short service officer and Cranwell cadet all come in to the R.A.F. on an equal footing. They start as learners and each and every one must reach the same state of flying proficiency before he can hope to become a successful aircraft pilot. In accomplishing this we can truthfully say that the seconded officer is no more of a laggard than the other two. Are these three types of officers, however, on an equal footing on joining in other respects? Decidedly not. They are different. The seconded officer is a Royal Military College or Royal Military Academy graduate. He knows or is supposed to know the organisation of his service thoroughly and the functions of its various arms. He has also had some—if not considerable—practical experience in its operations prior to joining the R.A.F. Therefore, on graduating as a sound pilot he has but to learn the R.A.F. side of the applicaion of the army co-operation. The Cranwell cadet has possibly during his time at Cranwell touched briefly upon the organisation of the other services. His practical experience has been nil—therefore when he joins an army co-operation squadron he has to learn two sides of the army co-operation question—the R.A.F. and the army side. Thirdly, the short service commission officer is at an even further disadvantage. He starts knowing nothing about anything at all. This can be taken literally where army co-operation work is concerned. Squadron Leader Slessor expresses the opinion that exaggerated claims can be made in respect of having a thorough knowledge of the army. This is a very debatable point Either the work can be slurred over or done

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properly, and to achieve the latter a thorough knowledge of the army, its functions, operations and organisations is a necessity, and therefore to that end, nothing within reason should be left undone.

In his practical experience of the army and all its work a seconded officer always has and always will have the advantage over the other two types—taking it that their flying capabilities are approximately equal. He realises (particularly the seconded gunner officer), when firing a battery or batteries, what is going on in the operation he is observing. There are a lot of finer points which are only appreciated by those who have had previous practical ground experience—points which no teaching in the world, however good or cut and dried, can bring out, in the same way that practical experience can. To illustrate it with one small example. During certain Indian manœuvres a Cranwell, followed by a short service commission pilot-observer both reported certain "led-horses" as cavalry and cavalry patrols. The seconded officer who was up shortly after reported them for what they were, knowing full well from their very position in relation to the operation and to their formation that they could be nothing else, which he of course confirmed by a quick dive on to the object to verify his information. Again, without trying to belittle the honest efforts of others, it is frankly admitted that by far the most satisfactory results were obtained during the practice camp at Okehampton in 1926. This was in no small measure due to the activities of the acting flight commander, a seconded R.A. officer of considerable experience, who had been wisely chosen for the job, with which he was naturally *au fait* from both sides, air and ground, with the results mentioned. Previous flights had not been so fortunate in having officers with the same knowledge of both sides of the question, and one is forced to the logical conclusion that the results obtained could not possibly be up to the standard of a flight, equipped with pilot observers of practical R.A. experience. Numerous parallel incidents could be quoted.

It is urged that the seconded officer should return to army duties after a certain fixed period so as to keep in touch with army matters. Surely if it is considered necessary for the seconded officer to return to the army to "brush up" his knowledge, how much more important should it be that all officers employed in

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army co-operation duties should have initial practical army experience (which he *can* brush up). Yet it has been advocated to the writer by a senior R.A.F. staff officer and also in Squadron Leader Slessor's article that the Cranwell and short service commission officer, both with little or no army experience, make just as good army co-operation pilot-observers and are to be entrusted with the execution of that work for almost indefinite periods in peace and also in war. Yet in the same breath they advocate the "brushing up" of the seconded officer's knowledge in army matters, a knowledge which the short service commission and Cranwell officers have never possessed.

The essence of the seconded scheme, according to the authorities, is not to build up a reserve of army pilots "*as in war the seconded officer would not be available for use in the R.A.F.*" (this, readers will note, is a quotation and is direct from the Air Ministry to the writer) but to return the seconded officer to his unit to pass on his knowledge of the R.A.F. As that idea is advocated for the benefit of the army then surely the R.A.F. should have permanently in their midst—in senior positions in their units—as well as on their staffs, officers with a good knowledge of the army, its functions, organisations, and methods of operations. This appears the only logical deduction.

4. Suggested remedies.

So far numerous criticisms have been given, but mostly of a destructive kind without any suggested remedies. The possibility of a re-born Royal Flying Corps is out of the question, and in the writer's humble opinion impossible. If, therefore, the army are not to have direct control of its air arm it is only just and right to expect that it may have a share in its control, and it would appear that this might, to some great extent, be achieved by the army having a larger say in the personnel question of the army co-operation group. One can state with a fair degree of accuracy that hitherto the principal reason for the comparative success of army co-operation work has been because its senior army co-operation squadron officers—that is the squadron and flight commanders—have mostly had some practical army experience. They realise after short conversations what their respective army formations

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require of them, and yet even so, the co-operation could be *much* closer and the fault does not by any means lie entirely with the R.A.F.

In quite a short time is even this degree of efficiency likely to be existent when the senior army co-operation squadron officers are probably ex-Cranwell with no practical army experience? One should hope in time for definite progress, and yet, in the light of reason, one can expect, with the exclusion of the ex-army officers from posts of command in army co-operation squadrons, a definite loss of efficiency in army co-operation work as time goes on. Surely again there is some compromise to be obtained amicably between the two services concerned, a compromise which will, like all things, take time, but will only take longer by delay of action.

The writer suggests that something on the following lines might be adopted :—The seconding scheme to go on but on much broader lines. Certain officers to be encouraged to second. Here the regimental commanding officers *must* co-operate. Hitherto an officer seconded to any service has almost always been looked on with suspicion as the black sheep of the regiment, and this has dogged him even to the R.A.F. The terms of secondment might be made on some lines similar to those pertaining to the old Egyptian Army. Say an original engagement of four years and then subsequent consecutive engagements of two year stretches, dependent on the officer's willingness and his satisfactory air service, up to ten years. At this point the officer in question would have finally to decide as to whether he wishes to become permanent R.A.F. or to return to army duties, subject of course, in the first instance, to his fitness for retention in the R.A.F. It is quite reasonable to believe that a certain percentage—the larger percentage—will drift back to the army and thereby spread R.A.F. knowledge, but at the same time a certain definite percentage will be retained the R.A.F., who have practical army knowledge and at the conclusion of ten years' service (R.A.F.) be senior squadron officers.

Such minor points as a common promotion examination to ensure promotion in either service, entry to staff colleges, extra marks at promotion or staff college examinations for the seconded or ex-seconded officer, etc., could be arranged with a little ingenuity, energy, and amicability between the two services, so as

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to encourage secondment and to ensure that the seconded officer is not "let down" by his secondment. The question of pension also should be a very minor difficulty—if a difficulty at all as an officer with the double qualification of considerable air and army experience should be a paying proposition to both services. It seems reasonable that in time co-operation between *all* ranks of both services, senior and junior—which is so sadly lacking at the present time—may in some such way be achieved. It appears to offer the truest exchange of ideas and ideals.

5. Concluding discussion on

(a) The staff officer observer.
(b) Use of radio telephony.
(c) Dress of seconded officers.

There are three further points in conclusion on which the writer would like to comment. Two of them appear in Squadron Leader Slessor's article.

(a) *The staff officer observer.* Firstly, the damning and apparently rather unjust criticism of the staff officer observer (in particular the manœuvre case quoted). In the comparatively rare cases where the R.A.F. have a senior army staff officer enthusiast in aviation, he is a friend to be retained at almost any cost; not to be held up to ridicule for his efforts; after all we are all trying to serve the same end, and ridicule of the "trier" is the last way to achieve it.

(b) *Use of radio telephony.* Secondly, the slighting tone in which radio telephony was treated as a means of communication. It is the writer's personal experience (himself at one time a radio telephony sceptic of the deepest dye) of the enormous bounds of radio telephony work between R.A.F. and army. It would mean alone the unification of material for many purposes of observation. In the early 19th century there were many people willing to vote George Stephenson to Bedlam for suggesting such a mode of progression as a steam engine, and yet those self same people were far worthier of that institution.

(c) *Dress of seconded officers.* Finally a curious and seemingly small point which the writer has not yet seen mentioned any-

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where, and which will serve perhaps partly to illustrate better almost than anything else the feeling—or rather, perhaps, that lack of genuine trust and good feeling which should exist between army and R.A.F., a good feeling for which both services must strive. When the writer was originally seconded the dress regulations concerning him were briefly as follows :—He wore the service dress and mess dress of his parent unit and in addition was given £25 to purchase one set of R.A.F. service dress for ceremonial occasions. This latter portion of the order is, of course, beyond comment or reproach. The order was, however, changed, and the seconded officer only retained the mess dress of his parent unit, without any further additional grant. This, needless to say, hit and still hits the seconded officer's pocket, as, of course, he cannot possibly exist for his period of secondment on one suit of R.A.F. dress (which is all that £25 will cover), particularly if the seconded officer is ordered abroad.

But this is quite a minor point. It appears, however, to the writer to have a far further reaching effect—almost a psychological effect—in the following way. It not infrequently falls to the lot of even the junior army co-operation squadron officer to get into touch with the army formation with which he is working to discuss certain points in an operation. And also at the conclusion of operations to land and confer with the formation commander and other officers. He has "to get the ear" of these senior army officers, a comparatively difficult task for a junior. Without trying to cavil, the difference in manner and mode of discussion when the pilot appeared to army officers as one of themselves instead of being totally disguised as a junior R.A.F. officer, was nothing short of remarkable to the writer. In both cases he was personally unknown to the many units concerned. When he appeared as one of themselves the rapidity and ease with which discussion was carried through was in marked contrast to those occasions when he appeared as a junior R.A.F. officer. On the latter occasions the army invariably felt it incumbent upon themselves (and, in the writer's humble opinion probably not without just cause) to protract considerably the discussions without that ease that marked former occasions, until informed that they were talking to one of their own kind. That state of affairs, at the latter period of the writer's

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R.A.F. service when he always wore R.A.F. service dress (a dress incidentally of which he was justly proud), always struck him as one of the most significant features illustrating the true lack of army and R.A.F. co-operation.

Conversely, it is also felt by the writer that a pilot on landing to discuss questions with army officers would feel much more at home if he saw in their midst a brother pilot. This he could notice at a glance if army officers on returning to army duty from the R.A.F. might be allowed to retain their "wings," a badge of which all are proud. Yet even this is denied to the ex-seconded officer. He may in no way display his previous connection with the R.A.F. There are even at this early stage not a few ex-seconded officers, of whom the writer is one, who still manage, despite many difficulties and expenses to keep up their flying by aid of the light aeroplane clubs, and are therefore in actual fact just as fit to retain their "wings" as ever. It is felt by all ex-seconded officers that the concession of retaining their "wings" would be another of those outward signs which inexplicably go so much to help that true co-operation which is so vital to both services.

SUMMARY.

To summarise briefly. Army co-operation must remain an integral part of the duty of the R.A.F. The duties so entailed are undoubtedly of a highly specialised nature, and therefore to ensure that these duties can be carried out with the utmost efficiency and lasting benefit to both army and R.A.F., it is strongly advocated that a large percentage of the army co-operation group officer personnel be seconded officers. To induce officers from the army to second in the numbers required, certain advantages of service must be offered them. Those suggested are briefly :—

1. Transfer of a certain percentage.
2. Extension of seconded service.
3. Official recognition of R.A.F. service in
   (a) Assistance at promotion examination.
   (b) Assistance or nomination to staff college or R.A.F. staff college.
   (c) Employment on R.A.F.—army liaison duties after return to the army.

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4. Retention of "wings" throughout service.
5. Assistance to maintain touch in actual piloting and army co-operation duties for those who have to return to army duty.

When this is done both services can feel that lasting foundations for true army and R.A.F. co-operation have been well and truly laid, and the building erected on that foundation should give real satisfaction to one and all.

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RE-ORGANISATION OF DIVISIONAL ARTILLERY.

By Major H. C. H. Eden, M.C., R.A.

IN his concluding paragraph the author of the "Duncan" Silver Medal essay for 1926-27 says that his main object has been to arouse argument and criticism. This article is an attempt to put forward a few points on the other side of the argument, especially with regard to his proposal to finance the suggested re-organisation at the expense of the number of weapons.

There can be little ground for controversy in the author's opening statements in which he emphasises the importance of artillery, which he calls "the very embodiment of fire power in its most potent form," and which he considers to have become "almost the paramount arm" in a modern army. But, after laying stress on the value of the artillery, he states on page 160 that "it is considered that the present divisional artillery possesses an unnecessary number of guns" and he proposes that "the numerical gun power be drastically reduced." Here it is that several readers may be expected to differ from him. Neither will all regimental officers be found to agree with his theory that a large addition to the staff of divisional artillery headquarters, even for such important duties as survey, will give such added efficiency to batteries as to justify this reduction in the number of guns. His proposals (tabulated on pages 170 and 171) entail the reduction of the number of guns in a divisional artillery to two brigades. One brigade is to consist of a 3·7″ how. battery and two 18 pr. batteries, and the second brigade of an 18 pr. self-propelled battery and two 18 pr. batteries. All batteries are to consist of six guns and to be mechanised by the provision of cross-country transport. The author, although he does not definitely say so, apparently intends these two brigades to be responsible for anti-tank defence (p. 167) and the anti-aircraft defence of the forward area (p. 175), in addition to providing the necessary covering fire to the infantry they are supporting.

One of the great lessons of the late war was the inability of the infantry to advance against modern weapons without adequate covering fire. The sole object of divisional artillery is to enable

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the infantry of the division to retain its mobility, and, in discussing any re-organisation of divisional artillery we must therefore commence by considering what it is that the infantry want. For economy's sake we cannot hope to provide for every eventuality that may occur, but we must confine ourselves to their certain needs under average conditions. First and foremost the infantry require covering fire to enable them to go forward. Experience teaches us that in any advance however rapid there will be periods of semi-static warfare when organised defence will force the pursuers to halt and organise an attack. Such an attack must be delivered with a carefully thought out "fire plan" combining artillery and machine guns and will take some time to prepare. Automatic weapons have very great fire power, are easy to conceal, and only offer an extremely small and difficult target when discovered. Their numbers have been so increased in modern armies that it would appear that both in attack and defence some form of barrage or screening fire on tactical points will have to be provided. This necessary screening fire can be provided most efficiently and with the minimum of delay by tanks. But the high initial cost of these machines, combined with the expense of their maintenance in peace, makes it improbable that we shall possess them in sufficient numbers at the commencement of a campaign. The provision of this fire will therefore be the main duty of the divisional artillery.

A division acting on a maximum frontage of 6000 to 7000 yards (F.S.R., pages 103 and 160) is likely to require at least 1600 yards of screening fire to cover tactical points, whether in attack or defence. At 35 yards per gun, which may be regarded as a distinctly optimistic figure, this works out at 46 field guns or howitzers. Even when tanks are available they themselves need a considerable measure of artillery support and the above number of guns will be required to protect them from anti-tank weapons and to fill the gaps. Further, this need of covering fire for the tanks is likely to increase with the introduction of an A.P. machine gun. Although the employment of smoke would reduce the number of guns required, its use is so dependent on weather and climatic conditions that we cannot rely on it. Further, to enable them to advance in face of those hostile weapons which have been omitted

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from, or failed to be neutralised by the "fire plan," the infantry will require a certain number of direct support weapons of special design placed under their command and acting in the closest liaison with them. Pending the introduction of more reliable means of inter-communication on the battlefield than at present exists, these supporting artillery units must move in close proximity to the infantry they are supporting, if that support is to be obtained *in time*. Their forward position, combined with their rôle as weapons of opportunity, will not permit their inclusion in the fire plan, and their limited facilities for observation will not normally allow a section to cover a greater frontage than that of a battalion. We shall, therefore, require a battery for each infantry brigade. In addition to the above at least 24 field artillery weapons will be needed for harassing fire, etc., and to assist whatever medium artillery may be available for counter-battery work.

Our minimum requirements are therefore about 70 field artillery guns or howitzers and 18 light artillery weapons. The author of the prize essay has very ably stated the case for six-gun batteries, and it is agreed that these are the most efficient and economical. Not everyone, however, will agree with his proposal to abolish the 4·5″ howitzers. The cry in war is always for greater shell power and, for financial reasons alone, the author is not likely to see the realisation of his somewhat half-hearted proposal that mechanical traction will enable the 18 pr. to be replaced by a weapon of heavier calibre. The power of concealment of modern automatic weapons, combined with the comparatively small numbers of artillery available in mobile warfare, is likely to force commanders to an increased use of smoke whenever possible. While the 18 pr. is the least economical means of projecting both smoke and gas, the 4·5″ howitzer has proved its value for this purpose, and the tendency during the late war on all fronts was to demand an increase in the number of these useful weapons rather than their abolition. Owing to their high angle fire and heavier shell field howitzers are easier to conceal than 18 prs., and are particularly useful for attacking gun emplacements and hasty entrenchments. Their H.E. with 106 fuze is good against infantry in the open. It is suggested, therefore, that, if still available, it would be advisable to retrieve some of these weapons from war stocks.

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"In the later stages of attack when there are few or no telephone wires, when the division is working on a wide front, and where the situation is repeatedly changing, any centralised control of the guns is out of the question." We shall, therefore, require in the divisional artillery one artillery brigade to work with each infantry brigade, and our minimum requirements work out as:—

18 light artillery weapons,
35 4·5″ howitzers,
35 18 prs.,

organised in three artillery brigades. One commander can deal with 5 subordinates. Each of our three field artillery brigades should therefore consist of:—

2 4·5″ howitzer batteries,
2 18 pr. batteries,
1 light artillery battery,

all batteries being of six guns or howitzers.

The author of the essay recommends the wholesale mechanisation of the divisional artillery. Owing to the possibility that neither the Dominions nor India may be able to follow suit in the near future and that money is not available to carry out the mechanisation of our "Main Army"—i.e. the Territorial Army—this is a question that bristles with difficulties. It is of course desirable that the Expeditionary Force should not differ radically in organisation from the rest of the Imperial Army. otherwise the army at home would find it difficult to fulfil its peace rôle of providing drafts for India.

It has been ruled that the principle of economy of force forbids the inclusion of medium artillery or tanks in the permanent organisation of a division, but they will be attached to divisions according to the situation, the ground and the number available. The same ruling surely holds good for anti-tank guns. War against an army strongly equipped with tanks is only one of the conditions for which our expeditionary force must be prepared and, when it does occur, the enemy may be expected to use these tanks massed (but not necessarily shoulder to shoulder as the author visualises) on a particular front. The organisation of anti-tank artillery must, therefore be sufficiently flexible to allow concentrations of guns on those fronts which appear particularly suitable for tank attack.

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Similarly anti-aircraft weapons must be capable of rapid concentration for the defence of important localities. This flexibility will not be obtained by including anti-tank or anti-aircraft artillery within divisions. Although it would be a great advantage if our field artillery could undertake effectively anti-tank and anti-aircraft defence when required, it is against the principles of war to allot more than one task to one body of troops in battle. The divisional artillery we have proposed above are required to provide covering fire for the infantry, and cannot also efficiently undertake the duties of anti-tank or anti-aircraft defence without neglecting this, their primary rôle. Any guns required for these purposes must be provided for in addition from corps or army resources.

The author's picture of a C.R.A. sitting up aloft, discovering machine gun nests and other targets invisible from the ground, and switching the accurate fire of his batteries on and off these targets as required, is a splendid vision. But, alas, it is likely to remain a vision. The difficulty of observing an 18 pr. shell burst in battle is very great, and the principles of economy of force and economy of material again forbid the permanent distribution of valuable aeroplanes to such small formations as divisional artilleries.

The author very rightly stresses the important factor of "financial stringency." But if a married man finds his growing family necessitates an increasing expenditure he does not cut their grub to pay for their schooling. Rather he sells his car, or cuts down his wine bill. Similarly in national finance true economy is not to be found by dividing expenditure into small watertight compartments. The principle that "if the gunners want an increase they must find the money" is a false one. Our efficiency vitally affects all the other arms and it is our duty as gunners to urge the minimum requirements for the efficient performance of our rôle.

It is suggested that the proposals put forward by the author of the prize essay will not enable the artillery to give the infantry the support for which they ask. The facility with which modern weapons can be concealed combined with a probable increased use of smoke will make the accurate location of targets extremely difficult if not impossible in future wars. The fire power of modern weapons has driven the covering artillery further and further back from the infantry they are supporting, whilst existing means of

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communication are not at present sufficiently reliable to enable information obtained by the infantry to be passed back to the artillery *in time*. Pending the further development of means of intercommunication, it would appear that the main rôle of the divisional artillery will be the provision of covering fire over considerable areas rather than the destruction of small individual targets. Such fire necessitates an adequate supply of ammunition and considerably more weapons than the author has allowed. Further, although it would be an undoubted advantage if divisional artilleries were capable of engaging hostile tanks and aircraft, this is not their true rôle. Additional guns are required for this purpose and, to obtain the most economical use from them, they, together with artillery aeroplanes, should be under corps or army control and allotted to divisions according to their requirements. Modern developments in war would appear therefore to have necessitated an increase rather than a decrease in artillery weapons.

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THE INFLUENCE OF THE SIX-WHEELER UPON DIVISIONAL ADMINISTRATIVE QUESTIONS.

By Lieut. W. B. V. H. P. Gates, M.B.E., R.A.S.C.

RESULTING from the extended employment of M.T. for Army purposes, and the development in particular of the 30 cwt. pneumatic tyred lorry, a considerable re-organisation of Supply and Transport Services, as operative in the field, was introduced on the 31st of January, 1926. The advance in military transportation made since this date by the evolution of the W.D. rigid framed six-wheeler cannot fail to exert still stronger influences upon administrative questions. In view of this the new organisation, although but a year old, already appears to require a certain degree of re-orientation. In order that this question may be considered in the right perspective, it will be as well first to attempt to predict the probable trend of events as far as mechanisation as a whole is concerned.

1. *The future of mechanisation.*

The rapid growth of aviation and the advent of tanks coupled with the tremendous development of scientific weapons, which especially characterises the present era, has placed the need for mobility, brought so strikingly into relief by the late war, first among the chief military questions of the day. Apart from any purely tactical considerations, this is rendered all the more important by the probability that one of the chief strategical objectives in a great war of the future is likely to be enemy air bases, and that in the event of air supremacy being doubtful or actually lost, the employment of highly mobile land forces against these, may be the only possible counter to intensive air attack. It can therefore be said with some degree of certainty, that the role of military forces from now onwards, will be one demanding an increasingly high degree of mobility, and that the trend of present development is towards the evolution of small but highly efficient striking forces capable of moving at 100 miles per day. In view of this, Napoleon's dictum "L'activité ! L'activité ! ! La Vitesse !" may well be taken

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as the keynote of modern preparation for war. Mechanisation, and all that it implies, is now generally recognised as presenting the only solution to this vital problem of mobility. Progress has however been retarded for several years, by a lack of suitable vehicles, not only satisfying military requirements, but of distinct commercial value.

The W.D. six-wheeler in which these somewhat conflicting factors are successfully reconciled has at last removed one of the chief obstacles in the path of mechanisation, which will doubtless now proceed as rapidly as financial considerations, and the growth of a reserve in the form of vehicles in everyday commercial use, will permit. It is unnecessary to describe the six-wheeler in any detail, as it has received much attention since its first appearance in the Aldershot Divisional Training of 1926. It will be as well, however, to give here the load capacities of the two types at present in use. The light vehicle which is specially suited to first line transport purposes can carry 1 ton across country, and 30 cwt. to two tons on the road, although the lesser weight represents the nominal military load capacity. The medium can carry 2 tons across country, and 3 tons or over on the road. Both these types are capable of a maximum road speed of 30 to 35 miles per hour, and have as high a cross country performance at least, as the horse drawn L.G.S. wagon. As mechanisation gradually progresses we may expect the light to be employed for first line and to a certain extent for second line transport; the medium for second and third line, also possibly for field artillery traction; while the heavy, of which the six-wheel-drive Hathi tractor now being experimented with is an example, should prove invaluable for artillery and other heavy haulage purposes.

Apart from the outstanding suitability of any particular type for a specific military function, there is the question of the general supply of vehicles in war from civilian sources, which must ever be the deciding factor in determining the ultimate selection and allotment of M.T. for the army. The policy to be adopted in regard to matériel will therefore depend not purely and simply on military expediency, but to a large extent upon industrial and economic conditions. No matter which type of six-wheeler is employed however, we are safe in saying that the mechanisation

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of first line transport will do much to increase the mobility of all arms, particularly cavalry, whose chief rôle in normal country will at any rate in the near future be largely confined to one of reconnaissance, in co-operation with multi-wheeled armoured cars and various types of light tank. Where infantry is concerned, this new development will remove the restrictions upon embussment at present imposed by slow moving horse transport, and may be a step towards the day when all infantry units are conveyed in cross-country vehicles, and play a secondary part of consolidation, in battles between tanks and other mechanised arms. In any case the carriage in six-wheelers of machine gun subsections, complete with guns and crews, should greatly enhance the tactical value of these weapons and may result in their being employed by the infantry in far larger numbers, if not formed into independent units.

The increased mobility of machine guns will in turn necessitate larger numbers of tanks, which, as the Great War conclusively proved, are the only really effective antidote to the latter. As the employment of a new instrument of war is invariably followed by counter measures, so large numbers of anti-tank weapons, mounted upon, drawn behind, or loaded in six-wheelers, and dependent mainly upon their speed for protection, will in time become essential. The high mobility of these various "land-craft" and the mechanically transported "land-marines," to use one of Captain Liddell Hart's terms for the infantry of the future, will demand even greater powers of movement for artillery. Thus gun traction, and the conveyance of battery headquarter staffs by high-speed cross-country machines will become obligatory, and is likely to necessitate radical changes in gun carriage design. It will be no doubt a matter of time alone before guns mounted on pneumatic tyred wheels are evolved to replace existing types, which are not altogether suitable for mechanical draught. These would have to incorporate some quick method, probably hydraulic, of grounding the carriage in order to give a firm firing position. The idea of mounting a gun on a tractor, as in the case of the Birch, although making for speed in getting in and out of action, does not appear entirely sound, as breakdown on the part of the tractor, ipso facto, immobilises the gun. For this and other reasons, amongst which questions of financial stringency and civilian vehicle reserves figure

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very largely, we are likely to find field artillery tractor-drawn, rather than tractor-carried, by which is meant incorporated in a mechanically driven machine, at least for some years.

To return to the prediction of general future developments, this speeding up of artillery and other arms will not only add proportionately to the difficulties of ammunition supply, but of all administrative service, while heavy long range bombardment of railways, and harassing fire on other lines of communication, must also be expected as a natural corollary. In conjunction with air attack, this may at times lead to complete disorganisation of rail transportation and consequently throw increased strain upon road systems, which in turn are always liable to be disrupted to a certain extent by cratering or blockage. The employment of high-speed six-wheeled vehicles for administrative purposes may therefore become imperative, not only forward from railhead, but throughout the chain of supply. There are numerous other tasks to which we may expect this new form of transport to be applied.

The use of persistent gas on a big scale, for the purpose of denying to the enemy certain lines of approach, and localities of specific importance, is likely to become an outstanding feature of future warfare. This will demand large numbers of high-speed cross-country vehicles for the carriage of gas containers, etc., and correspondingly mobile transport for the rapid circumvention of gassed areas. The transportation of all kinds of bridging material, particularly essential to highly mobile operations, is yet another need which can alone be adequately met by the employment of cross-country transport, while the utility of the latter for reconnaissance purposes, wireless tenders, staff cars, travelling offices, and the collection and evacuation of wounded, is at once apparent. In fact one can affirm without fear of contradiction, that the evolution of the six-wheeler will, when the history of the present and the near future is written, be said to mark an epoch in the development of land forces.

2 *First line and train mechanical transport.*

Having attempted to adumbrate the general trend of mechanisation, we will now turn to the organisation of transport for administrative purposes. It must be recognised that likely changes

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in the existing organisation, with which we are about to concern ourselves, cannot possibly materialise in their entirety for some years. At the same time it is as well to attempt to formulate plans for the future at an early stage, in order that suitable foundations for the developments which are bound to come may be laid as opportunity offers. Before dealing with the more rearward units of the supply chain, we shall first consider the probable composition and functions of first line transport under future conditions. It is not proposed to discuss, in relation to this, the many tactical advantages which mechanisation will confer, but to trace, if possible, the effect on organisation in rear, which its influence upon the interior economy of units is bound to exert.

In the highly mobile operations of mechanised forces, warfare will of necessity assume far more open characteristics than at any previous time. It will be usually essential therefore in order to insure adequate protection for units' administrative transport, or "B" echelons, from artillery fire, and the local penetrations of hostile armoured cars, etc., for these echelons to be kept as far in rear as possible. The same also more or less applies to second line transport, except in the case of small forces operating independently, when transport would probably be most secure if retained comparatively close to the main body. Apart from any question of security, the "away back" position is highly desirable for both "B" echelon and second line transport, in order to minimise movement, smoke, etc., in forward areas, which might disclose important positions and exert a restricting influence upon the freedom of action of the fighting forces. On the other hand, although the tendency would be, as we have seen, for the latter to be more widely scattered than in the past, the time available for distributing food would be reduced, both on account of the general speeding up of operations, and the greater distances to be covered in bringing it forward from concealment areas in rear. This means to say that considerably less time is likely to be available for cooking, and that a method of rapidly distributing food over large areas will be essential. Yet another difficulty arises in connection with the extensive movement of troops by bus column, which the mechanisation of their transport will facilitate, namely the question of high speed field kitchens, or food carrying vehicles, to accompany

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embussed units and to form part of their mechanical transport under normal conditions. All these desiderata point to the need for a new system of feeding in the field.

A solution to this problem, successfully tried on a small scale during divisional training in the Aldershot Command last summer, is afforded by the speed and radius of action of the six-wheeler, appropriately termed as it has been, the modern instrument of mobility. All cooking is carried out under divisional arrangements at communal cooking centres in concealed areas, usually from 5 to 25 miles, according to circumstances, behind the line; portable ovens being carried when not in use, together with other cooking facilities, in divisional train vehicles specially allotted for the purpose. After partial cooking, half an hour usually being sufficient, food is taken at the boil, in suitable anti-splash containers, and placed in hay boxes, or other receptacles of a thermos nature, where it will continue to cook gradually, without spoiling, for periods of between 24 and 48 hours if unopened. A complete day's cooked food is prepared in this way, consisting of dinner, tea, and breakfast, to which a haversack ration is added.

The normal procedure in regard to delivery to units, is for six-wheelers in which the hay boxes or thermos containers have been packed, to be dribbled forward at dusk to brigade meeting points, and from there guided to respective units. If possible, these vehicles should, it is thought, be provided on a scale of one for every field kitchen and officers' mess cart in the present establishment, as this would greatly simplify and expedite the distribution of food to sub-units, especially when widely dispersed, as in future we may usually expect them to be. Having delivered the dinner, or main meal of the day, and tea later, or at the same time, the distributors would normally remain during the night, with or in close proximity to units until breakfast and the haversack ration had been issued. They would then return, if possible before dawn, to the divisional train concealed areas, and during the day pick up at the cooking centres another 24 hours' meals which had been got ready from bulk supplies brought up the night before from railhead, by the maintenance company. Although there are numerous details which require working out in connection with this method of supply, it is readily seen to be adaptable to almost any conditions

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or circumstances, and to be especially suited to the requirements of highly mobile operations. Its advantages on the score of economy and simplicity are also obvious.

The substitution of six-wheelers for field kitchens would do away with the need for divisional train supply vehicles, enable "B" echelons of first line transport as such to be dispensed with, and thus effect a considerable cut in vehicle establishments, desirable from every point of view. Water vehicles of some description, probably trailers, would of course remain essential. By virtue of greater load capacity, both in regard to weight and bulk, presented by the replacement of limbered G.S. wagons with six-wheelers, a reduction in "A" echelon transport as constituted at the moment, should also be possible. Thus weight now carried on the man or mount, could be dealt with by surplus vehicles, without increasing the present vehicle strength of the division, thereby conferring greater individual mobility. The weight which it is suggested could be taken from dismounted men would be roughly 6 to 10 lbs., and consist of the complete pack, possibly less ground-sheet, and if the general situation permitted, a percentage of S.A.A. Two stone, approximately, could similarly be taken from the horse, in the case of mounted troops. It is considered that vehicles employed to carry these articles should belong to the divisional train companies, and should accompany the distributors when sent up with hot food at night, as packs, etc., would normally be required at that time. There appears to be no reason why the blanket and greatcoat vehicle of baggage sections should not also deliver simultaneously, as by doing so, fewer unit and transport personnel would be required for guiding and conducting purposes. These vehicles, in common with all others of the train, should, as has already been pointed out, be six-wheelers.

The rearward location of divisional train concealment areas, would of course mainly depend upon the general situation, topographical factors, and the relative position of the cooking centre, which under the new system, would replace the supply refilling point of the old. The location of the former would in turn be mainly influenced by the first two above mentioned factors and by the distance in rear of railhead. When this was only a matter of some 50 to 60 miles, cooking centres could be kept within 10

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miles of the forward zones providing that this was compatible with tactical requirements, in which case the maintenance company would have a daily each way run of some 40 to 50 miles. Under such circumstances it might be found advisable to select divisional train concealment areas in fairly close proximity to cooking centres, as in any case the former would, in mobile warfare, be usually located at least 6 or 7 miles behind the front line. This arrangement would be particularly advantageous from the point of view of the interior economy of the divisional train as a whole, as under the existing régime baggage and supply sections of brigade companies are rarely together for any length of time, baggage sections being usually retained in special localities somewhat nearer to the fighting troops than the supply sections, which in most cases have to run back a distance of 25 miles or so to railhead or refilling point, during the day. This renders effective control on the part of brigade company commanders practically impossibile, militates against the fullest utilisation of repair resources, and necessitates undue dispersion of personnel. The petrol supply question, which will become ever more vitally important as mechanisation progresses, is another factor which demands the reduction of M.T. to a minimum in forward zones; refilling in the comparative safety of concealment areas many miles nearer railhead, presenting of course far less complexity, and being more economical in time and effort.

From the point of view of the divisional commander and his transport adviser, the C.R.A.S.C., the maximum concentration of a division's transport which this new system will induce is also in keeping with the fundamental principle of centralised control, so essential where transport is concerned. The co-ordination thus effected, would greatly simplify vehicle maintenance questions, and permit the fullest possible utilisation of all transport available. In this respect, the proposed reduction in first line transport, and the inclusion of all vehicles thus withdrawn in the divisional train, is seen to be particularly advantageous, while the increased control of the latter's sub-units which this system affords, would greatly facilitate embussing arrangements in the event of transport being required at short notice for this purpose. Such a contingency is likely in future to become fairly common, and would of course

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involve the dumping of normal loads. In view, however, of the high speed and wide radius of action of the new M.T., this should not present any real difficulty.

The question of type of six-wheeler with which second line transport should be provided in order to enable it to meet the demands of tactical as well as purely administrative functions is therefore introduced. Here the principle of homogeneity in connection with makes and types of vehicles is the main consideration, in order that the provision of spares and replacements may be simplified, and to achieve the highest possible interchangeability in matériel throughout the division. Apart from these desiderata, the equipment of second line transport with vehicles identical to those of first line transport is also important for tactical reasons, in that it would be most desirable for an embussed column, composed as it might be of both, to have a common denominator, as far as speed and cross country ability were concerned. Strictly from the point of view of economy, the light six-wheeler with which we may expect "A" echelon transport to be equipped would be the most suitable as a distributor vehicle, owing to the likelihood of loads being more bulky than heavy.

On the other hand the medium type would probably be the better for baggage carrying purposes, as loads in this case would be of somewhat greater density. Both distributor and baggage vehicles might, however, after their arrival at unit headquarters, often have to deliver to widely dispersed sub-units, and therefore the light six-wheeler, having the best cross-country performance, and being the smaller and thus the least conspicuous of the two, would on the whole be preferable. This would also be in accordance with the principle of homogeneity. The bridging question, which is particularly pertinent, should be the definitely deciding factor, and would appear to favour the lighter vehicle. It must not be overlooked that the latter, although restricted to a nominal 1 ton load for cross-country work of difficult nature, can however deal with weight in excess of this over reasonably good terrain, and when employed on roads and similar flat dry surfaces, is able to carry 30 cwt. or even 2 tons. Having outlined the proposed general organisation of first line and train transport, and leaving for a moment the important, but so far unconsidered, questions of

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ammunition and petrol supply, we will now pass to that of the third line formation which will link up the division with railhead.

3. *Third line transport.*

The maintenance company, as at present organised, appears to require no radical modifications, with the exception that it should be equipped with medium six-wheelers in place of the 3-ton, solid-tyred, four-wheeled lorries, at present provided. The high speed and radius of action of the former type, would enable it to cover daily without much difficulty a return distance of approximately 100 miles between divisional cooking centres and railhead. Although in highly mobile warfare, it is to be expected that distances will be greatly increased, this figure would, in all probability, be rarely exceeded, except perhaps in the event of railways being dislocated or non-existent, when all links in the chain of supply would have to be expanded to maximum limits. In such cases divisional cooking centres could probably be established up to 35 or 40 miles in rear, although 25 miles should it is considered not be exceeded, unless absolutely essential. The maintenance company would then work back a matter of 65 to 75 miles, thus making a total daily run of 150 miles, which medium six-wheelers should be able to compete with at least temporarily, if not for any length of time. In considering the operation of mechanical transport, we must guard against basing our estimations of its capabilities upon purely mechanical factors. The final victorious drive of the Allies in 1918, when M.T. drivers were nearly "all out," affords an illustration of the strain thrown upon administrative services, particularly those connected with transportation, in any sudden lengthening of the chain of supply. At the same time it must be borne in mind that in dealing with modern transport of the 30 m.p.h. pneumatic tyred six-wheeled type, the strain of driving is infinitely less than with the old 3-ton solid-tyred lorry, with its 12 m.p.h. rate of speed, and ceaseless vibration. In fact both the medium and light six-wheelers are almost as comfortable to drive as an ordinary car.

Even taking this into consideration, however, the stress of driving at high speeds for a distance of 150 miles per day, possibly under the worst conditions, would be supportable for comparatively short periods only, especially if drivers had also to clean and look

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after their own vehicles. It is quite possible that in the next war, it may be found advisable to institute the London General Omnibus Company's system of maintenance in the case of M.T. formations working more of less continuously over long distances. Under this system gangs of fitters and cleaners take over vehicles as they come in from work, and get them ready for the next day's running, while the drivers, having written out defect reports, are freed from further responsibility until coming on duty again the following morning. In the event of railhead being situated further than 50 miles from the cooking centres, other than temporarily, it would in all probability be necessary to insert another link in the chain of supply. This could most easily be effected by allotting two maintenance companies to a division, and working these on alternate days, as was done with the old cavalry divisional trains.

In considering the radius of action of distributor sections, there are also factors other than those of distance which must be taken into account. On arriving at unit's headquarters, vehicles would have to distribute to sub-units, often necessitating driving in the dark without lights, in many cases over difficult ground. This would impose a severe strain on driver personnel, as also upon vehicles and would demand ample opportunity for rest and running repairs. At the same time, in the event of these vehicles being needed before dusk, as would often happen in summer, it might be necessary to dribble them forward from concealment areas, singly or in groups of two or three, a lengthy proceeding. Again, the possibility of the train being required for embussing purposes at short notice renders necessary the presence of its vhicles within a reasonable radius of the division at all times. It would appear advisable, therefore, normally to restrict the distance to be covered daily by distributor sections to a maximum one of 50 miles, which means to say that except in cases of emergency cooking centres should not be further in rear of the front line than 25 miles, and when other factors were favourable, considerably less. Under the supply system proposed, the position, say at noon, would be that units had consumed breakfast and were carrying a haversack ration; 24 hours' food was at cooking centres waiting to be taken up at dusk by the distributors, while maintenance companies were loading a further day's rations for delivery to the former that evening.

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The nett result of the foregoing proposals would, it is maintained, be seen in all round improvement and speeding up of administrative services, fuller utilisation and control of transport resources, and also where the latter were concerned, a considerable reduction in vehicle numbers, by the elimination under ordinary conditions of a link in the chain of supply—field kitchens and supply vehicles being merged into the distributor sections of the divisional train. One important fact which is particularly brought out is that owing to the speed, cross-country ability, and wide radius of action of modern transport, field operations will soon be far less influenced than they have been in the past, by the position of railways We will now pass to the equally vital questions of ammunition and petrol in connection with which the distances in rear of rail-head and the radius of action of the maintenance company given above, will equally apply.

4. *Ammunition supply.*

In great wars of the future this will be a problem of some magnitude for, as we have seen, we may normally expect units to be far more widely dispersed, and to change their positions more rapidly and frequently, than under existing conditions. In order to expedite distribution and to organise transport on an economical and highly flexible basis, it is suggested that S.A.A. vehicles at present included in first line transport establishments might be incorporated with advantage in the ammunition company. The latter would provide an ammunition supply officer, vehicles, and the necessary personnel for each brigade as instructed by division. This officer would be under the orders of the colonel commandant and responsible for maintaining all units of the brigade with S.A.A. As the provision of this vital commodity is entrusted to an administrative corps as far forward as brigade headquarters, there is no reason why this responsibility should not be extended to include that of distribution throughout the actual fighting zone. The number of vehicles detailed to form a brigade S.A.A. section would depend upon the general situation and the role assigned to the formation in question, and might vary in consequence from time to time. A percentage of this allotment would normally be pooled and formed into a reserve, as is usually done at present,

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the remainder being allocated with battalions as circumstances demanded. Thus, for instance, a unit to which two S.A.A. vehicles had been detailed, would as soon as one of these became empty, receive a filled one in replacement from brigade reserve. The empty vehicle would then return, via the latter, to refilling point, subsequently coming up again to a rendezvous, or regulating point, from which it would be dispatched in due course to one of the brigades.

In open warfare all routes from the rendezvous to brigade reserves would be patrolled and marked with direction signs, by ammunition service personnel. The brigade ammunition supply officer would be provided with despatch riders for conducting vehicles to and from units and for general liaison purposes. (In trench warfare the same system would be applicable, the carrying agency in this case being either pack animals or working parties.) The main artery back to ammunition refilling point would be similarly dealt with, fitter squads and petrol tank vehicles being located at intervals. In order that adequate supervision and control might be exercised, the S.A.A. section of the ammunition company should it is thought, be sub-divided into two echelons, each under an officer definitely responsible for the operation of that portion of the supply chain with which it was primarily concerned. Thus the O.C. rear echelon would organise and control supply from ammunition refilling point to the rendezvous exclusive, at which point the O.C. advanced echelon would assume responsibility. Both echelons would be generally co-ordinated by the O.C., S.A.A., section, in turn under the orders of the ammunition company commander, and the C.R.A.S.C. of the division. In this way, although giving effect to the degree of decentralised control necessary under the circumstances, this system should constitute in practice a general pooling of transport which would obviate loads being transferred from one vehicle to another, and thus ensure rapidity and volume of supply.

Moreover, being organised on the principle of continuous interchange of matériel and thus highly flexible, it should be adaptable to all and any conditions. The employment of high-speed cross-country transport would also reduce the likelihood of congestion or disruption on the lines of communication and enable brigade reserves to be located further in rear than is at present

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feasible, on account of the restricted radius of action of horse transport. The O.C. advanced echelon would be responsible for maintaining communication with the ammunition supply officers of the brigades, and in keeping up the requisite number of loaded vehicles with each. To enable him to do this a S.A.A. rendezvous would, as we have seen, be necessary, to which all transport reported on arrival in, or departure from, the divisional area. Vehicles could then be directed to brigade reserves, according to the respective requirements of the latter, which would enable divisional headquarters to exercise considerable control and to ensure that priority was given to any brigade needing S.A.A. particularly urgently. The additional use of trailers would greatly increase the load capacity of vehicles and thus serve to reduce transport requirements—a consideration of some importance in view of the future air menace. By a rapid exchange of filled for empty trailers much time and unnecessary man-handling of loads could often also be obviated.

It is suggested that gun ammunition supply might possibly be worked on somewhat similar lines, for it can now be but a matter of time before all artillery is mechanised. It is more than probable that with the exception of actual gun tractors, other artillery transport will consist of six-wheelers. These are capable of drawing a field gun in emergency and, apart from their excellent cross-country performance, have high road speed and are moreover certain to find a place in the commercial world—all important desiderata.

It is acknowledged that the foregoing proposals are somewhat unorthodox. The problem of transportation in a future war of movement is however likely to be such that every possible means will have to be utilised to ensure rapidity of supply. In the attainment of this, centralisation of control in order to effect economy is of paramount importance. Apart from such considerations the system outlined in the foregoing would not only greatly simplify questions of vehicle repair and replacement, but ensure that personnel and matériel were equally worked, and thus prevent undue strain being put upon any one link in the chain of supply. The advent of improved instruments can almost invariably be followed with advantage by improved methods of applying them. Thus there is little doubt that the speeding up operations brought about

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by high-speed cross-country transport will in future necessitate changes in organisation which give effect to the fullest possible co-ordination of administrative resources. Since the beginning of the century a constant tendency in this direction has evinced itself, as exemplified by the evolution of the D.A.C. and the divisional train from the previous second line transport of individual units, and more recently the absorption of the former's "B" echelon by the ammunition company.

5. *Petrol supply.*

This, of all administrative questions, is likely to present the greatest difficulties. It is impossible in the scope of this article to describe in any detail the system by which it is thought this vital supply could be most easily maintained, although many pages might be devoted alone to the base arrangements, which will be necessary for dealing with the prodigious requirements of a mechanised army. It is considered that the most economical method of coping with this problem would be for the train to be provided with petrol trailers on a scale commensurate with the daily requirements of the division. At night, vehicles going up to distribute food and baggage would take with them filled petrol trailers, of between 100 and 200 gallons capacity. These would either be used to fill up "A" echelon vehicles, which, with full tanks and spare tins, should have sufficient petrol for at least 150 miles, or be exchanged for trailers included in "A" echelons, normally empty at the end of the day. The best method would probably be for "A" echelons to keep one or more trailers as a mobile reserve, these being thus exchanged, when empty, and for all their vehicles to be filled from the trailers brought up at night by the train. The latter would in addition be provided with a percentage of cross-country tank vehicles as a mobile reserve, these being either sent back to railhead for refilling, or being exchanged for filled ones brought up by the maintenance company. The empty trailers of the train would in the same way be exchanged as far as possible for filled ones brought forward by this unit.

6 *The divisional reserve horse transport company.*

Where a division was equipped with light six-wheelers, both for its first and second line transport, this company would

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nominally be surplus to requirements, except in certain types of closely wooded country, where pack animals might be necessary. As, however, the nature of the terrain would usually be known before the commencement of a campaign and this form of transport consequently provided universally, we may for our purpose ignore this exception. If equipped with light six-wheelers the existing company could be used as a divisional mechanical transport reserve, which besides enabling the train or ammunition company to be supplemented at will, would at times be extremely useful for embussing purposes, and for replacing seriously damaged vehicles. It would, however, appear more advisable for it to be included in corps troops as an additional reserve M.T. company. Such units will, as mechanisation progresses, be required in large numbers, as a means of providing additional maintenance companies or other extra links in the chain of supply in emergency. Apart from any consideration of centralised control, or economy in resources, the sum total of M.T. vehicles within the division will normally be such that the greater the reduction in numbers which can be effected, the better.

7. *Conclusion.*

One is safe in saying that at no other period in the history of our military forces have we been confronted with such radical and far-reaching changes as at the present time. The British Army to-day is structurally a somewhat unwieldy product of slow evolutionary methods which could with advantage be re-fashioned into a well-balanced and symmetrical whole. The re-orientation of ideas and the re-organisation of functions, which these changes as they materialise must inevitably cause, should therefore afford an opportunity for the complete reconstruction, which is already overdue. At the same time the extreme complexity which scientific methods and means invariably produce, must not be overlooked in planning for the future.

Thus, mechanisation, despite its many evident advantages from the strategical and tactical points of view, is likely to give rise to innumerable complications and difficulties in the administrative sphere. The vital necessity for laying sound administrative foundations before attempting to build up a mechanised force of any size

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becomes all the more apparent when one considers the question of petrol supply and the inherent vulnerability of oil storage installations both at home and in a theatre of operations. This is again accentuated by the fact that the British Empire actually produces at the moment only some three to four per cent. of the world's petroleum output, which, in view of our growing requirements, is a hopelessly inadequate amount even in peace.

The provision of M.T. to meet the heavy demands of mobilisation is another equally tricky problem, in connection with which it must be stressed that in the event of hostilities during the next few years, machines of the cross-country type will in all probability be far less easily obtainable than were road vehicles in the past, and are in any case certain to be required in far greater numbers. Thus, in war, petrol supply and civilian vehicle reserves constitute two factors of paramount importance which are bound to exert, at all events in the initial stages, a curtailing influence upon the employment of M.T. and to demand strict economy in its allotment. Much, of course, will depend upon an efficient repair organisation in the field in order that the maximum number of available vehicles may be kept in operation. In this connection, homogeneity, whereby the largest possible number of transport units, vehicles, components and spare parts are readily interchangeable, is imperative, for only in this way will it be possible to pool resources, and so effect the economy in personnel and matériel which is as much a principle of sound organisation, as of war. All these desiderata point to the need for centralised control in the highest possible degree, which, in relation to the maintenance and operation of M.T. is, as in the case of all forms of transportation, essential to success.

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SYNTHETIC PETROL.

By Captain C. A. P. Murison, M.C., R.A.

THE future supply of liquid fuel is a matter of increasing interest to all who use or in any way depend on mechanical transport, whether this transport operates on land, on sea or in the air; to the fighting services in particular it is sure to become a problem of vital importance.

The period since the war has witnessed an unprecedented increase in the number of vehicles of all kinds that rely for their motive power on petrol or on some other derivative of mineral oil, with the result that the consumption of these products has enormously increased.[1] In this country, for example, the consumption of petrol rose by 100,000,000 gallons in 1926, or approximately 20%. Proportionate increases may be assumed for the progressive countries of Europe and for America, and are likely to continue for an indefinite period, since the exploitation of motor vehicles and aircraft shows no signs of abating. So far the the supply of motor spirit has met all demands, and the increased consumption has been marked not by a rise in the price, as might be expected, but by a decline. But the additional supplies have been obtained by improved methods of cracking and refining from a diminishing output of crude oil. So great indeed have been the improvements in the method of treating the raw material that three times as much petrol as before can be extracted from a given quantity of the crude, and if the price were to rise sufficiently to cover the higher costs involved the yield could be even further increased.

Nevertheless, the world's supply of mineral oil is rapidly being consumed, and though the most contradictory estimates of the available reserves have been published it is certain that sooner or

[1] The rise in the consumption of petrol since the war is indicated by the following official figures for imports:—

1918	644,000	tons.
1923	1,341,564	,,
1926	2,063,288	,,
1927	1,484,452	,, (first seven months.)

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later it will be necessary to rely on other sources for liquid fuels. Consequently chemists and chemical engineers in all countries have been exploring the possibilities of obtaining synthetic petrol and related products from raw materials such as coal, vegetable oils and cellulose.

This question of discovering efficient substitutes for petrol and other petroleum products is of peculiar interest to us in view of our present absolute dependence on oversea supplies of oil, originating to a great extent in areas under foreign control. In peace dependence on foreign sources for an essential requirement of every day life may become both economically and diplomatically embarrassing; in war it is likely to lead to disaster. It is not surprising, therefore, that the Government, through the Fuel Research Board, is, at the present time, examining the possibility of utilising on a commercial scale the various methods that have been devised for obtaining liquid fuels from raw materials other than mineral oil.

The present article is an attempt to give an account of some of these methods without entering into technical details, to examine some of the factors which affect their development, and to consider how far they are likely to contribute to the emancipation of our fuel supply from foreign control.

For convenience it is proposed to consider the processes under two main headings, viz. :—

(a) Those which aim at producing fuels akin to the distillates of mineral oil.

(b) Those which aim at obtaining power alcohols in sufficient quantities and at a low enough cost to enable them to compete with petrol.

Under (a) there are :—

(1) A whole group of processes which may be most conveniently considered under the heading "Low Temperature Carbonisation," many of which have reached the commercial stage of development.

(2) The Bergius process of converting coal into oil which is being exploited on an industrial scale in Germany, and

(3) A method due to a French chemist, Professor Mailhe, at present only in the experimental stage, of transforming vegetable oils into a substance closely resembling petroleum.

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Under (b) come :—

(1) A number of processes closely resembling each other, which aim at the synthesis of power alcohols from coal.

(2) Various methods of obtaining these through the action of bacteria on cellulose.

Low temperature carbonisation.

Benzol and tar have been obtained from coal through high temperature carbonisation for many years, by processes which have now reached a high degree of perfection. Coal, therefore, has long been indicated as a promising source of liquid fuel, and various methods have been tried to obtain increased yields. In England and America the process most in favour has been that known as "Low Temperature Carbonisation," so called because the raw material is subjected to much lower temperatures than those usually employed in gas works and in the production of metallurgical coke. Speaking generally, the process possesses two great advantages over high temperature carbonisation :—

(1) The yield of liquid fuels is higher.

(2) A smokeless fuel, suitable for the ordinary domestic grate and for industrial purposes, is created.

In addition gas is produced which, though comparatively small in quantity, possesses a high thermal value which makes it useful for mixing with ordinary gas to improve its quality.

About 200 different methods of low temperature carbonisation have been successful on a laboratory scale, and of these a number are now operating on a commercial basis. The yields of gas, smokeless fuel, and other by-products such as motor spirit and fuel oil vary with the particular method. By some of them as much as three gallons of motor spirit have been obtained per ton of coal treated, and several yield over two gallons. One authority[1] assumes 2·6 gallons of motor spirit per ton a practicable yield for low temperature carbonisation and on this basis has calculated that if it were possible to subject to this process all the coal now consumed in the United Kingdom (about 120,000,000 tons per annum) 312 million gallons of motor spirit, or about half our present require-

[1] John B. Kershaw, F.I.C., F.S.S., "The World's Future Supplies of Liquid Fuels." *Engineer, March 4th, 1927.*

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ments, would be obtained, as well as some 1320 million gallons of heavy oil fuel.[1]

Under favourable economic conditions, therefore, low temperature carbonisation would do much to decrease our dependence on outside sources. The main purpose of the process, however, is the better utilisation of coal, the principal product being coke not oil. On the sale of this coke its economic success must ultimately depend. Consequently the expansion of the industry is only possible if the advantages of smokeless fuel become more widely recognised, and if the rich gas produced during carbonisation can be profitably disposed of.

For these reasons the Government has formed the opinion that the process can be most economically developed with the co-operation of the gas companies. Accordingly it has been arranged, with the assent of the Fuel Research Board and the good will of the Gas Light & Coke Company, to establish a subsidiary company, the Fuel Production Company, the capital of which is to be guaranteed under the Trade Facilities Act. The capacity of the proposed plant will be some 100 tons a day.[2] The operation of this plant will, in the course of a few years, provide valuable data for estimating the profits to be expected under normal working conditions, and if these profits are sufficiently attractive there is little doubt that the country will see a rapid expansion of the low temperature carbonisation industry in the near future.

Apart from making a valuable contribution to our supplies of liquid fuel the establishment of this industry on a satisfactory basis will have further important results, such as the recovery of many other valuable by-products which now escape up the chimney, and the reduction of the smoke evil.

The Bergius process.

Like carbonisation processes this method starts with coal as its raw material, but, unlike those processes, is primarily concerned with obtaining a maximum yield of liquid fuel. Dr. Bergius in fact converts pulverised coal into oil by mixing it with 40% oil

[1] The cost of the plant necessary to establish the industry on this scale has been estimated at not less than £60,000,000. *Report of Director of Fuel Research, 1926.*

[2] See annual report of the Fuel Research Board and report of Director of Fuel Research for 1926 (H.M. Stationery Office, 1s. 3d. net).

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(which may be obtained from the process) and treating it with hydrogen gas at temperatures up to 600° C. and pressures as high as 200 atmospheres, iron oxide being added. The process can be applied to all kinds of coal, except anthracite, and yields a substance closely resembling mineral oil. The further treatment of this product is similar to ordinary oil refining, and can be undertaken in existing refineries without the addition of any special plant. After purification the liquid products amount to from 40 to 50 per cent., by weight, of the coal treated,[1] or from about 700 to 1100 lbs. per ton of coal. Now the imports into the United Kingdom of petroleum and allied products amounted in 1925 to 6,150,000 tons,[2] and on the basis of the lower yield it is clear that if the Bergius process can be exploited industrially on an economic basis the whole of our imports could be replaced by the hydrogenation of some 15½ million tons of coal, or about 6½% of the present annual output of our mines. It is claimed, moreover, that the motor spirit obtained by this treatment is of a very high quality and has the same anti-knocking properties that characterise a mixture of petrol and benzol.[3]

The process, which is protected by patents in all countries, has naturally attracted world wide attention. In this country the Government has recently granted £25,000 to the Fuel Research Board for investigating it, and at their Fuel Research Station a plant has been established which deals continuously with a throughput of about a ton a day. The high temperatures and pressures involved naturally give rise to very difficult engineering problems, but these have been surmounted, at any rate so far as the small

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[1] The yields from typical British coals tested at the intermediate scale continuously working plant established by Dr. Bergius at Mannheim-Rheinau are approximately:—

Crude oil and spirit	50 to 60 per cent.
Gas	20 per cent.
Partially converted organic matter	15 per cent.
Water and inorganic matter	the remainder.

These yields refer to the coal actually treated, no allowance being made for that required for heat, power and the production of hydrogen used in the process. *Report of the Director of Fuel Research, 1926.*

[2] See table published with the report of a lecture by C. Earnest Fayle, delivered at the Royal United Service Institution, January, 1927, "The Supply of Raw Materials in Time of War." *Journal of the Royal United Service Institution*, page 555.

[3] Ormandy and Craven reported a yield of 10% on the weight of the coal and fair anti-knock properties as shown by the composition:—unsaturates 3·1%, aromatics 7·6%, napthenes, 51·7%, paraffins 37·6%. *J. Inst. Petr. Tech., 12, 77 (1926).*

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scale plant referred to is concerned. The work of the investigators is now being directed to the discovery of the best conditions of temperature and pressure, the most suitable coals, and the most satisfactory through-put per unit of plant for each type of coal. In Germany[1] three large factories have been erected to give an output estimated at 1,000,000 barrels of oil a year. It is yet too early to say whether, under present conditions, the liquefaction of coal is economically sound. The process, however, can be applied to many types of inferior coal normally disposed of as "waste," so that the cost of production would appear to depend primarily on the cost of hydrogen, interest on capital, and maintenance of plant. In view of the pressures employed the last item may be high.

With our resources in coal the successful development of this process in Great Britain would have far-reaching effects. In addition to making us self-supporting in the matter of liquid fuel it would also do much to re-establish the coal industry as one of our greatest assets. The future in fact might see Great Britain an exporter of oil instead of the world's greatest importer.[2]

The Mailhe process.

Professor Mailhe has patented a process by which animal and vegetable oils are transformed, by heating with certain metallic salts, into an oily liquid resembling petroleum, from which petrol and illuminating oil as well as other products can be obtained by fractional distillation. In the course of his researches he has obtained a conversion amounting to from 60 to 70 per cent. of the original oil. Work on similar lines has given satisfactory experimental results in Japan and Italy. There does not appear to be any immediate prospect of the industrial development of this process, but in the future it may prove of considerable importance to those countries fortunate enough to possess areas of tropical vegetation.

[1] Plants are working at Lenna, Ludwigshafen, and Kötshen. At Lenna 4000 tons of coal are dealt with daily, and in 1928 the capacity will be raised to 300,000 tons a year. Lignite is used. Contracts for the delivery of 120,000 tons of oil this year have been signed and the German railways have agreed to transport it at specially low rates. Prices will be low enough to compete with imported oils. *Chemical Age, September 17th, 1927.*

[2] The United States is actually the greatest importing country but is excluded since the imports are mostly from Mexico for refining and re-export. American exports in 1925 exceeded imports by 1,650,000 tons. Table, page 555, *Journal of the Royal United Service Institution*, already referred to.

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POWER ALCOHOL.

Though we are not limited to one alcohol for power the term "power alcohol" is commonly reserved for ethyl alcohol, the possibilities of which as a motor fuel have long been realised. Its heating value, however, is only about three-fourths that of petrol, and though this difficulty could be overcome to a great extent by altering the compression ratio of internal combustion engines, and modifying the design of carburettors, it is not to be expected that motor manufacturers will take this step unless ample supplies of this fuel are available and as easily obtainable by the motorist as petrol is now. At the present time the supply is quite inadequate and the price much too high to permit of its use as a petrol substitute, as was quickly discovered by the French, who attempted to economise petrol by enforcing the use of a petrol mixture containing 10% of alcohol only to find that the supplies were quite unable to meet even this demand.

The attractiveness of alcohol as a fuel has rested on the fact that the raw materials for its manufacture are plants, and are therefore continually renewed by nature; but it is sometimes overlooked that some of these, like potatoes, sugar cane and sugar beet, are in constant demand as food, and therefore command a price which prohibits their use as a source of fuel. The tropical regions of the world, however, contain vast quantities of rapid growing vegetation suitable for the manufacture of alcohol, if processes can be discovered that will permit of its production on a large enough scale, and at a low enough cost, to enable it to compete with, or replace, petrol. The general lines on which a solution to this problem is being sought will be indicated at a later stage in this article.

SYNTHETIC METHANOL.

Another "power alcohol" of importance is wood spirit or methyl alcohol, which, under the name of "methanol" is a common article of commerce. At the present time about one half of the world's supply is produced in the United States, where the industry has been developed on a large scale; but during recent years the synthetic production of this commodity has met with a large measure of success and has excited considerable interest. The synthesis,

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like carbonisation and the Bergius process, uses coal as its raw material, but the coal is first converted into gas before being treated with hydrogen in the presence of a catalyst.

Three processes, two German and one French, have reached the industrial stage of development, but it is still too early to hazard an opinion as to their ultimate economic success. The processes are:—

(1) The Badische Anilin und Soda Fabrik's.
(2) Drs. Fischer and Tropsche's.
(3) General Patart's.

The first and third of these methods are substantially the same. Indeed, so similar are the patents that it is doubtful if that of the Germans can be maintained in foreign countries against the prior claims of the French. In both the hydrogenation of the gas is carried out at high temperatures and pressures, a wide range of metallic elements being claimed as catalysts. The Fischer and Tropsche process, on the other hand, can be carried out at normal pressure though much the same temperatures are employed. One of its advantages is that it can make use of blast furnace gas, not infrequently a waste product in large iron-manufacturing districts. The products to which the names "synthol" and "gasol" have been given are obtained by the process, and it is claimed that the conditions for producing benzol have been determined.

So far it is belived that only the Badische Anilin und Soda Fabrik has produced synthetic methanol on an industrial scale, the output being used in their own works for the production of dyes and resins.[1] In France the "Société Nationale de Recherches" has provided the capital for the erection of an industrial plant near Lille, and this is nearly completed. Here an attempt will be made to exploit a variation of the Patart process due to M. Audibert, and great results are confidently expected.

The estimated cost of the synthetic article is about one quarter that of the natural product, and if this proves correct synthetic methanol from Europe will be able to compete successfully with American wood spirit even in United States markets. It is probable, however, that for some years its chief use will be in the chemical

[1] Since this was written the writer has been informed that synthetic methanol is being made in the United States by the Commercial Solvents Corporation and also by the Dupont interests.

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industries rather than as a motor fuel in competition with petrol, to which it is definitely inferior.

Ethanol from cellulose.

So long as a substance as suitable as coal can be easily obtained it is unlikely that any important attempt will be made to utilise the vast store of potential energy represented by the luxuriant vegetation of the tropics. Experimenters have nevertheless been engaged in devising means of tapping this practically inexhaustible reservoir against the time when tropical plants are likely to be the sole source of liquid fuel.[1] The Mailhe process has already been touched on; there are in addition several methods which seek to produce ethanol from cellulose by bacteriological action, as a first step towards obtaining at an economic price substances more closely akin to petrol. From the results already achieved the prospects of ultimate success appear promising.

One method in particular deserves mention, namely—the production of acetone through the acetic acid obtained by fermenting cellulose, for acetone is an excellent fuel for adding to ordinary motor spirit, conferring anti-knock properties similar to a petrol benzol mixture. The cost of acetone at the present time, however, prevents its competing as a petrol substitute; but the acetic acid process may before long lead to its production in considerable quantities. If this proves to be the case the price may reach a competitive level and a new and valuable source of motor spirit be opened up. Incidentally it might be mentioned that acetone is a highly important material in the manufacture of explosives, where it is used as a solvent.

Conclusion.

The brief description which has been given of the various methods designed to lessen the world's dependence on petroleum brings out the fact that the most successful results have so far been achieved in Germany and France. This perhaps is not surprising. Both these countries import considerable quantities of liquid fuel—in the case of France about 2,000,000 tons a year—and both countries are fully alive to the danger of relying on overseas supplies,

[1] See "Fuel for Motor Transport." *Fuel Research Board Interim Report, 1920.*

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Germany from the bitter experience of the blockade, France from her difficulties both during and since the war. Consequently in both these countries considerable efforts have been made to obtain independence of foreign supplies.

In this country, on the other hand, there is a sublime faith in the ability of our merchant marine, backed by the navy if necessary, to supply us with all we lack under all circumstances. Consequently, though our imports of mineral oil and its products are about three times those of France, progress in this country has been chiefly confined to methods of carbonisation which aim at better utilisation of our coal resources rather than at the reduction of those imports.[1] Yet this is an aspect of the problem we cannot afford to neglect.

Quite apart from the extraordinary difficulty of safeguarding sea borne trade in time of war, and of obtaining the necessary tonnage[2] the total oil production of the British Empire—including that of areas under its control though, strictly speaking, not a part of it—falls considerably below the requirements of the United Kingdom. This means that the great oil exporting countries are in a position to exert strong economic pressure on us, if they so desire, in order to obtain diplomatic advantages.

Again, without adequate supplies of petrol and fuel oil the fighting services would be immobilised, and to guard against such a calamity it is necessary to maintain large reserves. This means the uneconomic employment of capital in peace, and in war provides vulnerable and highly important objectives for air raids. Even so it is quite impossible to accumulate stocks sufficient to meet more than the first requirements of the Services; consequently the safeguarding of producing areas under our control is a matter of supreme importance and may lead to serious commitments, of which the campaign in Mesopotamia is an outstanding example.

All these evils would be avoided if the country could be made self-supporting in this respect, and even if some form of subsidy

[1] The British and German problem also differs in this—we are concerned with the treatment of a material which in the raw state is a high priced fuel while the Germans are seeking some means of utilising their enormous deposits of low quality brown coal.

[2] In 1926, 1174 steamers and 158 sailing vessels were employed in carrying petroleum to English ports. *Board of Trade Returns.*

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were necessary to start a synthetic fuel industry the cost would be negligible compared to that of a Mesopotamian Campaign. We in Great Britain cannot in fact afford to neglect the possibilities of synthetic fuel any more than France and Germany, and for this reason it is encouraging to know that in addition to trying to place low temperature carbonisation on a satisfactory basis, the Government, through the Fuel Research Board, is exploring the possibilities of other methods that show promise, such as that of Dr. Bergius.

With our coal resources, we should find ourselves in a strong position indeed if a satisfactory method for obtaining liquid fuels from this material could be operated on a commercial basis; and in the future, when economic methods of producing substitutes for petrol from tropical vegetation have been perfected, as they certainly will be, the Empire with its great tropical dependencies might well become one of the main producers of liquid fuel in the world.

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THE ARTILLERY ARMAMENT OF AN INFANTRY DIVISION.[1]

By Lieut.-Colonel V. Buchalet.

Translated by Brig.-General W. Evans, C.M.G., D.S.O.

In the April and July, 1926, numbers of the "Journal of the Royal Artillery," will be found translations of two articles by Lieut.-Col. Buchalet, on Artillery Organisation. In consequence of certain questions about, and objections to his articles, Colonel Buchalet thinks the present time a suitable one to crystallise and develop some of the theories he propounded in them on the subject of the artillery armament of an infantry division. While he still adheres generally to the conclusions he arrived at in 1925, he now writes an article dealing with some of the objections raised, and once more emphasising his opinion that the armament of divisional artilleries must be modernised.

I. The light howitzer of the division.

The adoption of new propellants led to lengthened guns. Whereas the length of de Bange guns was 20 calibres, the 75 has 29, and the 145, 42 calibres. The German field howitzer 1898-1909 model has been replaced by the 1916 model with 22 calibres, and by a Krupp model with 20. Schneider is making a 15c/m howitzer for Denmark with over 20 calibres. The howitzer which we would like to see adopted for the *sole* divisional weapon (excepting accompanying guns) is a long howitzer—as long as the old de Bange 80 or 90 gun, but with this difference—wide field of fire and the use of variable charges. "Nearly every artilleryman," we wrote, "wants a light howitzer in the division, but opinions are divided as to the proportion of howitzers to guns." We advocated that the howitzer should be the only weapon. What then are the objections, other than sentimental, to this conclusion?

Here are some of the principal:—

(1) The range of the light howitzer is about 10 km. What is wanted is a gun of small calibre ranging up to 13 or 14 km.

[1] *Revue d'Artillerie*, July, 1927. L'armament de l'artillerie de la division d'infanterie.

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(2) The maximum rate of fire of a howitzer is 6 rounds per minute; a gun that can fire 15 to 20 rounds per minute like the 75 is wanted for emergencies.
(3) The division should have a modicum of heavy artillery to carry out demolitions required by the infantry.
(4) The hourly ammunition expenditure in number of rounds and weight of metal per area is inferior to that of the 75.
(5) Natural cover that cannot be searched by the 75 is the exception.
(6) The 75 has great moral effect as the shell arrives before the report of the gun.
(7) The 75 compares favourably with foreign field guns. It is unnecessary to make a change, particularly in a time of financial stringency.

Some of these criticisms have already been discussed in the previous articles, but we can do so now more completely.

(1) *Range.*

The shortness of range would be a great drawback if the tasks allotted to the divisional artillery (as a unit in an army corps) necessitated ranges exceeding 9 or 10 km. This should never be the case as neither we nor the Germans fight a battle with the division as the battle unit.

If in compliance with the Versailles Treaty the Germans keep everything in the division in times of peace, we all know they mean to use corps artillery much as we do. In France, and it is France we are discussing now, it is an accepted principle that corps artillery has a part to play in all the phases of an offensive battle: the approach march, contact, attack, and pursuit. Even in the approach march counter-battery work is undertaken by the corps artillery which alone has the equipment for this purpose (aircraft, intelligence branch) and it is a mistake to suppose that the corps artillery will only come into action after the divisional artilleries have become engaged. The occasions will be vary rare when divisional artillery will carry out counter-battery work during the approach march, so that the divisional artillery will not be in action unsupported and it will only be called on to undertake tasks affecting the division. Now the divisional artillery tasks during artillery

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preparation and the attack do not require ranges longer than 9 km. After zero hour the divisional artillery will be fully occupied shooting into a zone extending to an average of 3 km. from our own front line. Say that the batteries are in action 3 km. behind, then 6 km. will be the maximum range required.

If the infantry have advanced 3 km. the divisional artillery can still put down effective protective barrages, but this is the outside range for this nature of task, though it is true that concentrations on areas can be carried out up to another 3 km.—i.e. at a range of 9 km.—but once this limit has been reached batteries must be moved forward. Before zero hour the divisional artillery, more especially if armed with a howitzer of 85 or 95$^{m/m}$, can participate in counter-battery work.

All the hostile batteries that our own infantry want kept quiet are for precisely the same reasons less than 6 km. from their front line, and consequently from ours; the back areas too of the division such as command posts, refilling points, etc., will be found within this 6 km. limit. The consequence of all this is that divisional artillery will usually be called on to engage targets within a range of 9 km.

We have stated that protective barrages should not be fired at ranges exceeding 6 km. At this range the theoretical zone covered by the shell is 200 m. which should not be exceeded as will be the case if the range is lengthened. This applies to other series fired in support of infantry, such as creeping barrages and successive concentrations. While at 1500 m. a barrage from light howitzers produces a wall of steel and smoke 70 m. deep, which is the dream of every infantryman who has been over the top, the barrage from the same gun at 6000 m. is much thinner as it covers three times that depth. This is a most serious disadvantage. A dashing infantry will follow up the barrage as close as they can but the more cautious will hang back to avoid short shell even though they know that a few seconds' delay gives the enemy time to get up machine guns and stop the advance.

Lastly, if you give a gun a range of 14,000 m. it will be used up to that range with fatal results, for how can communication with the infantry be kept up at that range?

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Taking all these facts into consideration, a maximum range of 9 km. is ample for the gun of the French divisional artillery.

(2) *Rate of fire insufficient.*

The 75 is credited with 15 to 20 rounds per minute. Actually 6—8 could be fired for short bursts of less than 5 min., 4 rds. per minute up to 15 minutes. During the war, mass production of H.E. shell necessitated the gun being fired by lanyard with the detachment behind sandbags, hence no great rate of fire was obtainable. Eight rounds per minute are quite quick enough for any nature of fire except an attack on the battery at close range, in which case machine and Lewis guns are the best defence. An 85m/m howitzer can easily keep up a rate of 6—8 rds. per min., and with low charges it can be maintained for longer periods than with the 75 gun.

(3) *The divisional artillery should have some heavy howitzers for destructive shoots.*

This question was gone into at length in the 1925 article. There is only one thing to add. The task of the divisional artillery is a very heavy one and should rather be lightened than added to. The ever increasing development of fire power necessitates increased artillery support for the infantry. Basing our estimate on the number of 75's used in the attack in 1918 we consider that 72 howitzers are necessary for the direct support of a division. These 72 howitzers must have an ample supply of ammunition as infantry are for ever asking for more artillery support. The management of this mass of guns and ammunition is a very big task, and so the attachment of the heavy howitzers to corps artillery is a distinct advantage.

(4) *The hourly ammunition expenditure and the weight of the ammunition will lessen the effect in area shoots.*

This is a very serious objection and as it has been raised by several officers, needs discussion at length. Firstly these officers are thinking about the 105m/m howitzer, while we are considering one of a much smaller calibre. Our idea was a 95m/m howitzer as a maximum, with the proviso that if the higher command considered that the weight, particularly as regards the tonnage of ammunition precluded it, the calibre should be still further reduced. As a maximum range of 10 km. can be obtained from a howitzer of

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85m/m, and as Schneider has actually produced a gun howitzer of that calibre, we are inclined to-day to recommend 85m/m. Thus it will be seen that the question is quite different from that of the 105m/m howitzer. Some of our officers, too, seem to have mixed up the 105m/m gun with the 105 howitzer when considering the rates of fire that can be maintained. The German 105 howitzer is capable of the same output per hour as our 75 with ordinary charges, viz.: 100 rds. per hour. A 95m/m or smaller howitzer can fire 150—200 rds. per hour with reduced charges, so that the number of rounds per hour is actually superior to that of the 75, thereby proving its suitability to be regarded as the normal weapon for infantry support. Now to turn to the question of the volume of fire. In the calculations of ammunition tonnage the weight of the complete round has to be considered. Taking the 75m/m gun of 1917 as a basis:—

The 75	round	weighs	10 kg.
,, 95	,,	,,	14 ,,
,, 85	,,	,,	10 ,,

For a howitzer firing variable charges the cartridge case should be done away with. It is dead weight, and as experiments with the 155 howitzer have proved an unnecessary luxury. From these figures it is seen that the complete rounds of 75 gun and 85 howitzer are the same, but the howitzer shell weighing 8·8 kg. contains 1200 gr. of H.E., as opposed to 600 gr. H.E. in the 75 shell. Thus we get a shell equally good for counter-battery work and for the bombardment of trenches, where the 75m/m shell is woefully deficient. The 85 also covers a wider zone. The 95 howitzer Lahitolle shell covers double the zone of the 75; the 85 no doubt would cover less but still would be appreciably superior to the 75. Hence for an equal tonnage of ammunition carried one gets more volume and better destructive effect from the howitzer.

Area shooting becomes more necessary every day, because owing to the development of fire power, targets hide and camouflage themselves to such an extent, that suspicious areas (rather than definite objects) have to be engaged. The small superficial effect of H.E. makes us favour the increase of the proportion of shrapnel with heavy bullets. A heavy bullet loses little of its effect from a high burst when curved fire is employed, but it could only be used

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with a higher calibre than 75 or the shell would not contain sufficient bullets. To recapitulate—the adoption of a light howitzer of 85m/m (or 95) would give the divisional artillery better results on areas than the 75 gun.

(5) *Slopes giving protection from the 75 are the exception on a divisional front.* (Précis.)

Steep reverse slopes can be engaged either by :—

(a) Increasing the range, hence adding to difficulties of communication.

(b) By the use of reduced charges.

(c) ,, ,, *malandrin* discs.

The author considers that it would be greatly to the disadvantage of national defence if these possibilities led to the postponement of the adoption of a light howitzer.

(6) *The moral effect of a high velocity shell.* (Précis.)

Only applicable to short ranges, counterbalanced by the material effect of a shell containing two or three times the bursting charge.

(7) *The 75 compares favourably with foreign armaments.*

This was true in 1919 but is not quite the case at the present time. Of all our potential enemies Germany is the strongest and the allies have helped her enormously by destroying her guns. She now has none, but has chemistry and aviation, whereas we are faced with having to embark upon a campaign with all our pre-war weapons, or models produced hastily during the war. It is necessary to add that our late enemies are experimenting with new guns made in Sweden or elsewhere, and if they elect to start another war in 19..... they are ready to commence manufacturing the very latest and most technically perfect materials. We also know that a whole system of artillery could be manufactured piece by piece without the Commission of Control knowing anything about it.

Having won the war it behoves us not to go to sleep and it is our duty to keep the general public fully informed if we are to be as well equipped in the future as our enemy who is a past master in the art of concealment. If artillerymen themselves had not been divided in their opinions on the subject of heavy artillery and field howitzers, Parliament would doubtless have voted the money for

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an artillery programme and we should have had both in August, 1914.

Actually at the present time the French technical branch have arrived at a 75 weighing 675 km. (900 on the road) firing up to 9000 m. as a howitzer, and an 85 gun-howitzer of the same weight on the road as the 75, with a split trail, firing a 10 kg. shell up to 15 km. as a gun, and as a howitzer a shell weighing 8·8 kg. containing 1200 grains H.E.

(Lieut.-Colonel Buchalet now enters on a criticism of certain statements in General Herr's book on artillery, published immediately after the war. His own ideas are not altogether in agreement with General Herr's, and after giving his reasons for differing on some points he concludes this part of his article by defining what he calls—the divisional light howitzer).

Calibre. 85$^{m/m}$.
Range. 10 km.
Shell (a) H.E. 9 kg. with 1200 gr. H.E.
(b) Shrapnel.
Elevation. 5° to 40°.
Traverse. 45°.
Weight in action. 1200 kg.
,, on road. 1800 ,,

(The 75 weighs 1140 kg. in action and 2200 kg. in order of march.)

For divisions operating in mountainous country he recommends:—

(1) A mountain gun-howitzer of 75$^{m/m}$ weighing 675 kg. and ranging up to 9 km.
(2) The same on wheels, weighing 800 kg.
(3) An extra light 85$^{m/m}$ howitzer firing a shell of 8·3 kg. up to 9 km. and weighing in action on wheels 900-950 kg.

II. Artillery of immediate accompaniment. (Précis.)

Col. Buchalet says that he hesitates to be as positive in his opinions on this subject as he is concerning that of the divisional artillery weapon. He defines the task of the accompanying weapon in the approach march (where its use is invaluable in preventing the premature use of divisional artillery), and in the attack. As

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these tactics are familiar to Journal readers it is not proposed to translate this part of the article but to go straight to a précis of his conclusions.

The targets usually to be dealt with are :—

(a) Fire weapons in the open or lightly protected, and

(b) Strong points.

For (a) a small shell should suffice provided that accurate high angle fire is employed. This points to the adoption of a weapon of 65-75$^{m/m}$ calibre that can be fired from behind cover. As ranges from 1000-1500 should never be exceeded, technicalities require a maximum range of 3000 to produce the necessary accuracy, but range should be kept short with the objects of keeping the equipment as light as possible, and to prevent it being kept so far behind the infantry as to lose its power of immediate intervention.

As regards (b), strong points that have survived the artillery preparation, the war has proved that a 75$^{m/m}$ trench mortar shell was ineffective. A shell about 155$^{m/m}$ is required. The present 150T trench mortar firing a shell weighing 17 kg. with a bursting charge of 5·4 kg. H.E. is one solution. The ammunition is cheaper to manufacture than that of a howitzer, but this mortar weighs 600 kg. in action and 950 on the road. Even if the mortar could be lightened without reducing the shell, the weight of the latter makes ammunition supply very difficult.

It seems hopeless to expect one weapon to carry out both these tasks, so one must have two—one of the Stokes mortar type to belong absolutely to the infantry, the other something on the lines of the 150$^{m/m}$ trench mortar to belong to the divisional artillery, but to be placed under the orders of the infantry regimental commander in battle.

NOTE.—In the *Revue d'Artillerie*, of September, 1927,[1] an article by an officer of the German war office is quoted as supporting Col. Buchalet's opinions on the value of howitzers. This officer taking the present German divisional artillery weapons into account, advocates the proportion of howitzer to gun batteries being increased to two howitzer to one gun instead of the reverse. Further, he considers that corps should have mixed groups of field artillery. Contrary to Col. Buchalet, the German officer wants to increase the range of the howitzer from 10 km. to 14 or even 16.

[1] A propos de l'armament de l'artillerie de la division d'infanterie.—*F. Lartier.*

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A MORNING'S SHOOT IN IRAQ.

By Lieut.-General Sir George MacMunn, K.C.B., K.C.S.I., D.S.O.,

Col. Comdt., R.A.

THE shooting in Iraq has recovered from the somewhat intensive handling it received from the Army in the quieter intervals during the war, and during the immediate subsequent period. The recovery, however, refers particularly to the Black Partridge, that prince of game birds, so familiar to sportsmen in the valley of the Indus and of the rivers of the Punjab, and to the lesser bustard or *Ubara*. The cover on the banks of the Tigris is considerable, and even when food and munitions were scarce, sporting cartridges seem to find their way up river. However so tired and battered the Army, an off day would see as many officers as could raise shot guns and cartridges making for any likely scrub. Close under the Persian Hills north-east of Bagdad, the valleys and scrub of the Jebel Hamrin, the low range which stands sentinel to the great Persian plateau, were an untouched preserve in the winters of 1917-18.

The game birds of the land are duck and snipe, sand-grouse of many varieties, innumerable as the sand on the seashore, all of which are not affected by hard shooting, being, except the grouse, migratory, and the *Ubara* and black partridge aforesaid, which being non-migratory, felt the effects of exploitation. During the War the military authorities soon provided some game laws defining the breeding season, and these the Army readily respected. Rules defining certain sanctuaries were not so readily acquiesced in, it being suspected, though unfairly, that the civil officers who expected to remain in the land, were trying to feather their own nests.

In certain districts, especially round Kut, the lesser bustard was plentiful. But never probably in any other portion of the world have sand-grouse been seen in such quantities. Driving in a car between Bagdad and Babylon I have seen them get up in the distance by the hundred thousand, till the whole horizon would

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be black with what looked like a vast dust storm. To shoot them it is only necessary to find those bends of the rivers and sand-banks on which they pleased to water, to fire away at them coming down as the driven bird, above the bluff or bush which hid you, undeterred after their wont, at the most extensive fusilade and carrying away also after their wont, twice as many number six as any ordinary bird. To the sharp watcher, however, the apparently untouched bird will come down two or three fields away, or what in that land is the field equivalent. Driving across the desert, in 1919, from Baiji on the Tigris to Kirkuk under the Kurdish hills, when the good Sheikh Mahmud had engineered his attempted *coup* against the British at Sulimanieh in the height of the hot weather, I was surprised to find myself passing through thousands of them, the desert being covered with their eggs, and it was obvious then how rapidly they must be increasing, and what was the reason for the vast hordes in which they rose from the ground in the winter.

The marshes of the lower Tigris and Euphrates are covered with duck and teal in the winter, but it was no easy matter to engineer a good shoot, in spite of the masses of reeds. The areas were so big that once the masses of birds were disturbed and the alarm given they would clear away and not readily come back, or come down within shot. Still strategy and tactic and malice aforethought would sometimes give the shikari some return for his pains, especially if he would quit his motor-boat betimes and take to the dugout of the marsh-Arab.

Snipe, however, were another matter, our good friend *Scolopax Indicus*, the Indian variety of the Full Snipe, and Jack galore were to be found on a good place on the Tigris that the writer wots of, and though the going be as bad as that in the Burman rice fields the yield would be equally as good, and just as in other places, the rule of the full moon certainly applied, viz. : that snipe move by night and usually when there is a bright moon. Given a good moon you might clear a *jheel* out one day and find it restocked two days later.

But the Black Partridge is the jewel of the pastime, and I will describe a day's shoot among them, as carried out in the comfortable and favourable conditions that sometimes obtained for me. War is not all day and all the year, intense, and now and again in Iraq

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I was able to take things leisurely for an afternoon. Because I was Inspector General of Communications and because my duties kept me on the move up and down the five hundred miles of river between Basra and Bagdad, and because I carried out those duties on a stern wheeled steamer from the far-away Chindwin river beyond the Bay of Bengal, I was able when work was slack to find time now and again to pull up at some spot less frequented by the Army sportsmen. I say the Army advisedly, because there was no knowing where His Majesty's Navy might not be a-poaching. A considerable force of gunboats patrolled the Tigris, and since as a rule there was nothing doing in their line, they were forced to patrol where the Black Partridge were tiresome. Now and again, however, I was able to pull up at some spot which my intelligence system knew of, unmolested by His Majesty's gunboats, Moth, Mantis, Green-fly, Gad-fly, and the like.

Because also my own sternwheeler was well equipped with searchlight and machine guns, I could move at night with some impunity and make up for time lost in the partridge quest. Also since I had a wireless, I could always touch the uttermost parts of my command and apply a needle where necessary, the fiercer perhaps to hide my own dallying, and by asking questions of G.H.Q. and making reports thereto, could display sufficient alacrity to enjoy a shoot in peace. And this would be a typical morning.

"All quiet on the Potomac," as the catchword of the American Civil War had it, the supply of steamers for Bagdad passing up river steadily, sick and empties passing down, but happily, well-equipped ambulance steamers allowed one peace of mind. Reports sent to G.H.Q., and impertinence or rather a *straffe* sent to the Commandant of a section of river lower down, to the effect that the flotilla of native boats full of fodder seemed to be taking it too easy . . . . in the Tel El Amarna tablets I notice that the good king Hammurabi of pious memory, sent almost identical messages up and down the Euphrates and Tigris in his day, four thousand years earlier, so that I am justified by precedent . . . . and breakfast duly eaten, the time to shoot had come. We are paddling up stream, a white but not dense fog rolling off the water, on which a few gulls are flitting, and guns and cartridges are being got out by the A.D.C. and an Indian servant. On the marshes right and left

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the fog is lying in low banks that looks like dry land, and over the mist the hedge sparrow blue of the dome of Ezra's Tomb is showing through the palm trees and above the fog. The sun is shining merrily and the fog is about to dissipate. Our shooting ground will be in the "Narrows," that forty miles of difficult navigation, when the Tigris has left its bed and is for the most part running in the marshes.

But if the water be poor the cover is good, and enough cultivation around to encourage the partridges, who hate an empty crop. But the "Narrows" are still an hour's steam ahead, and the only thing to do is to possess one's soul in patience, and sit on the bridge along of the skipper and the Arab pilot. These are both characters, the skipper we know as "Yukon," a delightful wild and woolly one, a lieutenant in the Inland Water Transport Corps, who has long driven a stern-wheeler on the Yukon River, picking up much knowledge of narrow waters, and a varied and eloquent vocabulary in the process. The Arab is a funny old cup of tea, with his head wrapped in a duster to keep the fog out, who spends his life taking steamers through the "Narrows." He gazes intently at the muddy swirls beneath the bows, and calls out at intervals "*ma wajib*," which apparently means lots of water. This is confirmed by a *kalasi* in the chains who has a pole marked with black and white foot marks and who calls out "*sare do bam*," a chant strangely reminiscent of the Irrawaddi. We pass Ezra's Tomb, the most beautiful sight in the distance, on the river. The art of making the hedge-sparrow blue tiles is, alas, a lost one. The shrine is a Jewish one, and there are several Jewish women washing pots on the plinth, no doubt praying at the shrine for heirs. It would seem that the good Ezra frequently returned from Palestine whipping up more of his people to return to their own land from the pleasant flesh-pots of Babylonia, and died on the Tigris during one of them, a disappointed man.

One of the girls is just balancing the copper "Rebecca" jug of the country on her shoulder and Yukon waves his hand at her, which produces a giggle and a hurried pulling of her veil. The stream is running hard and we have to dodge a tug with a barge on each side coming down stream like a crab, but as she slides past, Yukon rings his telegraph for full steam ahead, the pilot shouts "Ma Wajib," and we run alongside a sheltered stretch of

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bank out of the current, where a ruined watch tower marks the beginning of a semi-cultivated track. The lower deck is about flush with the bank, and a gang plank lets us ashore, myself and A.D.C., half a dozen men of the escort and two of the crew as beaters, an old spaniel and Yukon.

The old spaniel begins flopping about among the little dry irrigation channels, and before we are ready up starts a hare. Yukon is in my way, but Augustus, that is the generic name for my A.D.C's, lets off both barrels more in fright than in anger, and that hare is still running ! However, in a minute or two we get the beaters into line, and before even we start, up get a brace of cock birds, their beautiful speckled black plumage glinting in the morning sun. Augustus gets one, and my bird gets off, I am ashamed to say, with one leg hanging, however the spaniel should get him later. And then the fun begins. A brace on my right—hens and an old cock under my nose. I get a hen but am rather flustered. Then before we have picked up my bird four more are up with a whirr that puts us all off. Augustus gets one, but a thorn bush was in my way. There is no doubt we've got a virgin bit of cover, and the birds have never been shot at before.

"Go slow, Augustus, for God's sake go slow ! and keep that damned young Sikh from whirling his stick about. We shall walk over a dozen if the line hurries."

So slow is the word, and we move like a funeral, grasping our guns with that intentness which a few whirring birds under your very nose sets up. Yukon gets very excited and jogs my elbow. A hare has got away behind, I get him, but I hear some pellets rattle against the steamer, so close are we still to our starting point.

"The gooner," an old trapper that Yukon has picked up and brought along is on the bridge of the S.1., which is my steamer's number—we have not given her a more human name—though I have a suspicion that she is none other than the "*Falam*," a steamer from the Chindwin river which runs into the mighty Irrawaddi from the Chin Hills.

We push on, steadily, a step for a step, as you should when birds are thick and you would likely hear the ghillie say, "Nicely, su-r-r" as you get a right and a left at black game. The birds are more on the alert now and get up twenty paces away which is

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easier for your nerve, and we were getting the swing right, Augustus securing a couple and I one, and then a cock partridge breaks back and makes a bee-line for the smoke stack of the steamer. He gets away with four cartridges and like the Jackdaw of Rheims "not a penny the worse!" I hate that blazing back at a bird, it always pulls down your average. Swinging round again I could see that a clearing was coming in the scrub with a "bit of stooble" in it. Now Black Partridge, and for aught I know, all partridge, don't like running over the open, and also are chary of taking to wing. They will check for a minute at the end of this scrub even if they have been running along in front of you, and these particular beggars are devils to run.

I halted the line

"Augustus, you and I will get on to the edge of the scrub. There is a break just ahead; the beaters must wait till we call them to move. Don't you shoot at anything till we get to the edge. The beaters can then come on, and we ought to have some fun."

We did as I said, and restrained ourselves from firing at two or three birds which got up. Then having gained the edge of the bush, and having marked the range of one or two tussocks of grass in the "stooble," I called the line on. Standing where one was, one could see it all happening. The birds were running up to the edge of the bush, and then craning their necks out, loathe to break. But the heavy tread of the beaters and the swish of their sticks was too much. The birds started to whirr away in twos and threes, steadily. We shot hard, until at last the final lot came off in a clump, and I could not resist browning them, which brought down three. Yukon, who had come up close behind, was wild with excitement, at the fusilade and the whirring of the birds. I gave him my gun.

"There are a few birds still in the grass, Yukon, and I think I saw a hare that has still to come. Better perhaps leave the birds and lay for the hare."

Yukon began to wave the gun about.

"Steady with the gun, orderlies are scarce. Ah! there he goes!" and puss broke fifteen yards on his left, ears up and down as she stretched for dear life. Yukon let her have both barrels a couple of yards behind her. Augustus had been following her

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with his barrels and as soon as he heard Yukon's second go off and plough the red dust, he shot her nicely, rolling her head over heels. With a wild yell a young Moslem soldier rushed out, cut the throat to make her meat *Hallal* or lawful, since the Moslem like the Jew, must only eat kosher meat from which the crimson blood has been drawn.

The last reluctant partridge having been beaten into the air. it was time to pick up the birds, of which a round dozen were on the ground. The "gooner" had joined us, because he had seen a jackal from the bridge, and that had excited his trapping spirit. The jacks on the Tigris at this time of year carried fine pelts, and as he explained, there was hardly a fur on the market into which a modern furrier could not make a pelt like that! And as he trapped for all the big traders in the Hudson Bay Territory no doubt he knew. As I had seen the tawny pelt of a Jack slink away to our right, I gave him the gun and told him to try the dry water cut that ran fifty yards away, while we hunted our birds in the "stooble." It was not long ere we heard his shot and he returned holding his bag over his shoulder by its magnificent brush, in high glee.

There was still a couple of hundred yards of scrub to beat out after crossing the clearing, and this we proceeded to do, but just before we started there came the curious staccato cry of sandgrouse overhead, and a little bunch of seven came over on the lower flight, evidently making for water in the marsh hard by. Down we went in the hope of another lot, and very soon three more came, Augustus and I each securing one. We had hoped it might be a regular line and that we were in for a morning watering flight, but they were evidently an outlying lot, for save for a distant covey or two they were the last. However a mixed bag is always a charm in any shoot, and they went on to the other end of the shooting stick, an orderly from the Deccan remarking "*Pakourdi*," which is the term for sandgrouse in his part.

The rest of the scrub afforded some steady shooting, but the birds were now alert and better distributed. The excitement of a brace of male birds from the grass at your toes was over, and they were giving single rather long shots, so that to my disgust I sent a couple away with their legs hanging. I could almost hear

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the old ghillie saying, "Eh, Muster Garge, that's bud!" and I knew I deserved it. At the edge by the river bank, however, a quail got up under my nose, and I was man enough to let it get thirty yards away before I fired. The temptation is to shoot at a quail much too soon, and as they swoop at the flash, to miss them till you've got the knack, after which it is like shelling peas. Having secured the quail, a grey one, one had time to wonder what the devil a stray grey quail was doing there at that season too. But then you will hardly go anywhere for a shoot in the East without flushing a quail where you least expected, though I hardly looked for one within a mile of Ezra's Tomb. There was something fitting in the connection nevertheless, in what one might call their "Biblicity." A year earlier I understood the quail story of Exodus. Walking along the shore of the Mediterranean on the Asiatic side of Port Said, I had come on a series of little straw shacks a foot high neatly aligned, with a piece of old fishing seine closing one side of each little straw lean-to. I was told that these were quail traps, and that the quail coming over the sea every year on their way back from Macedonia, would be dead weary from their long flight. They would flop down on the first dry land they saw, snuggle under a tuft of grass or scrub, and lie immobile for at least twenty-four hours. They would crowd into the little straw traps, three or four together for warmth and rest, and in the morning the trappers would take them out by hand for the markets of Europe. Poor little beggars, what a shame! But now one sees where the Israelites got their quail marvel from. They were passing through the edge of Sinai by the "Ancient Way," just during the ten days or so that the quail trek was on, when quail in myriads were to be picked up for the asking. Incidentally the fact also settles for all time the controversy as to route, for the quail at most never fly more than half a mile or so from the shore. It is also said that they fly no more but start off on the run for their destination in Central Africa, which is as may be, but I can well imagine their wings had had enough of it, which may account for the quail of the Israelites, but not for that single quail on the Tigris bank hard by Ezra's Tomb.

All of which is a discursion, and as such hardly to be encouraged, especially as it is necessary to finish the shoot and get back to put the S.1. on her way again against the Tigris current.

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Finishing out the beat was simple enough, though at the far end the birds would not face the open, but broke back, so we turned about and walked towards the steamer, whose bridge and upper deck showed high above the bush. But excitements and excursions were no more. Some rather sullen partridges got up in front of us, out of shot when they could, and we only picked up four or five more on the whole beat. Another jackal slunk away towards the marsh, but we let him go, though at the next stage up river we came on a detachment of camels left behind sick by a corps marching up, and the old Indian officer in charge lamented that he could get no jackal meat. All the world over, said he, there was no medicine for a sick camel like unto jackal soup. His only complaint against the veterinary officer was that he had not provided nor even prescribed jackal. Fortunately the "gooner" had skinned his victim, but had not yet thrown the carcase away, so that my reputation for producing what was wanted at the right moment received another unearned increment.

However, the story of the jackal soup and what the famous camel doctor of the desert, known as the "*jadeedi*," said about it, does not really belong here, and the immediate business is to get the game on board.

An hour and a half had sufficed to beat out the whole of the small bit of scrub, and to come back to the starting point at the steamer. On the bit of green turf at the edge of the Tigris we laid out our bag. It was not a bad one for an hour and a half's casual shooting, for two guns, eleven and a half brace of black partridge, a hare, a nondescript quail, a mallard and two sandgrouse. Then conscience demanded her tally! How many cartridges fired? Augustus and I had shot much the same, and we did not count Yukon's excursion. Something between two and a half and two and three quarter rounds per unit of the bag. Might have been worse!

While we were counting the bag, and feeling the plump young birds, and admiring the plumage of the cocks and the mottled wings of the grouse, a bevy of Arab lasses had rolled up, from a matting hamlet half a mile away, with eggs to sell. Yukon produced a bucket with a view to seeing if any were sufficiently flatulent to float, for Arab eggs will outdo the freshest eggs of any London

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grocer in antiquity. When eggs that floated were rejected there was much chatter, and simulated indignation. Then the ladies produced for sale their earrings, heavy lacquered beads of wood, with a rupee or other silver coin hanging therefrom, which were suspended over the ear by a loop. They were not particularly engaging ornaments, nor were they valuable, but had a daintiness all their own. Previous experience had taught me that the pendant coins would be worth examining. Sure enough, three of the half dozen offered were Greek, either of the Alexandrine succession, or what was more probable, coins of the Sassanide dynasties who used Greek character. Now for a trial of bargaining. Such a chatter, sometimes archness, sometimes anger, from six little ladies as like as six peas in a comely round-a-bout mould, with regular little faces, and well shaped little chins, their faces marred with the blue tattoo marks which kept off the evil eye. Nature is very fair, and true to type, all the six were good to look on in a simple way, "One of these 'ere 'omely zort," in a manner of speaking, for it seems that only in the crowded cities of the plain is the female of the species ever uncomely. These little Arabs of the marshes lived a hard life in a hard climate, recking little of heat or cold, always grinning with good white teeth, and immensely interested in all that went by. Yukon was inclined to be *empressé*, but even in the marshes apparently the woman settles the distance, and they would have none of it. The red-faced weather-beaten old "gooner" did attract some attention, and a fish was pressed on him, which he somewhat grimly deigned to accept. And then they floated off in a dugout, leaving three ear ornaments, the richer by fifteen rupees in exchange, and we saw them no more. It was time to hustle our bag on board, up holdfasts and the like, and get on with the job, especially as a wireless message had come in from King Hammurabi, or rather General Maude, up river, to know when the Hell those grain ships were going to arrive, or words to that effect. Luckily he did not know that his Inspector General of Communications had tarried by the way to have a brush with the partridges.

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STEEPLECHASING.

By "P.A."

AMBUSH'S excellent article, on Steeplechasing in the Regiment of to-day, has stirred me to a few reminiscences of the same pastime in earlier days, lest it should be thought that there were no brave men before Agamemnon, or any steeplechasing prior to the Armistice, or good horses before "Ghent of Old." Comparisons are proverbially odious and are nigh impossible to draw with any fairness, for who shall handicap "Ghent" with some of the best of a generation or more ago? and though many keen critics were much impressed by the riding of one of the jockeys at last year's R.A. Meeting, it is hard to say how much better he may, or may not be, than the best of the bye-gones.

The present writer had the advantage of being one of those "Heaven-born" jockeys who rode a winner on his first mount; for if one is lucky enough to ride a few winners at the beginning, one gets a start and an advantage over perhaps immeasurably more competent but less fortunate riders, and may maintain the advantage for long before being found out. On the occasion mentioned, having alternately made the running and lain out of my ground for three miles on one of our park courses, I challenged the leader at the last obstacle and with my hands in my mouth and my spurs in the reins got the best of a desperate finish by half a length, amidst the cheers and congratulations of my contemporaries—I had only a few weeks' service at the time. I well remember asking the head lad, an accomplished jockey, as he led me in, what he thought of the race and what mistakes I had made, if any, and the good fellow's kindly reply, "well, Sir, it is generally rather better to ride a race rather more of one pace than what you did then." A further criticism of the race unintentionally reached my ears from the next compartment, when the return train to

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London had halted. "No, I never said as 'e didn't win the race, wot I said was 'e couldn't ride for toffee all the same." The horse being a generous animal, said nothing, or I might have had a third and still more crushing criticism to counteract the congratulations of my young friends.

All of us will agree it is the first winner that one remembers and every detail of this comes back to me now—two ruffians who tried hard to put me off the right course when I was leading, a brace of partridges that got up out of the long grass beside the course, a gallant friend who fell twice on his equally gallant but tubed mount, and when being advised by some kindly onlookers to desist from the contest in which he no longer had a chance, begged his advisers to wait for him at the same spot till after the race that he might have the satisfaction of coming back and fighting them. Bearing in mind that he was a cherubic and most sunny-tempered little chap, this little incident is eloquent testimony to the excitement engendered in the breast of the novice in a steeplechase.

"Ghent of Old" is himself somewhat of a link with the past, since I hear he was purchased as a colt out at grass by "Teddy," afterwards Brig.-Genl. E. J. R. Peel, who sent him to a trainer where he learnt to jump hurdles and take a nice hold of his bridle. Subsequently he started a strong favourite in a field of 20 in a hurdle race at Manchester to finish second: his owner then had him home and was soon to be seen on him "bridling" like a good polo pony and negotiating the trappiest Cheshire fences to perfection, his subsequent jumping at Liverpool which aroused such admiration may be due to this schooling by one of the bye-gones. "Teddy" in the middle nineties was getting a full share of mounts, and his knack of "getting the country" on jumpers with moderate reputations and at the same time being able to get all the speed out of them and invariably riding with his head, made him popular with the trainers, one of whom once said to me "We think Mr. Peel could be the best of all the amateurs if he would give all his time to it." Fortunately he was too good a sportsman and had too much sense to make such a sacrifice for so shadowy a reward.

He won many 'chases, many point-to-points and had one or two quite fast hunters in his time, of whom perhaps "Guy Fawkes"

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was the best. Bought off the flat as a three year old, he began to jump somewhat ungenerously while whipping in to the Woolwich Drag and fox hunting on second leave, but took to it better in Ireland two years later where he won the Army and other point-to-points, and finished up with a great race in the G.M. at Punchestown, beating all the good horses of the 10th Hussars. His final success was in a newspaper competition for the best named horse, which he won cleverly, being by "Westminster" out of "Adventure." Teddy left a popular reputation in Ireland, and when revisiting that sporting but unhappy country in portly middle age was accosted by an old and admiring jarvie with "Ah, here's the bhoy for the Pint-to-Pint."

Bidgood was riding well in Ireland about that time and loved nothing better than a "competeetion" in a big bumping field of erratic Irish riders. "Trotter" Carter was gracefully dropping out of the fray about this date, I fancy rather against his will as he had kept his weight and his quite remarkable nerve and keenness after many years' experience and much success. The late Jack Hanwell of polo fame, whose riding had been mainly done in India was now married and "had his pass stopped," the same fate had befallen Dick Heygate, a very remarkable figure in soldier racing, who was as successful and competent a trainer as he was rider. He told me he started racing as a last-joined subaltern in Cairo, by begging the Chaplain to enter his pony in a small soldier 'chase there, Dick undertaking to feed, train, school and ride the pony and the Chaplain insisting on their sharing the stakes if successful. The pony won and Dick's share of the modest stake was invested in a share of some other animal, and with no further call up of capital, it resulted at the end of his tour of service in India in a stud of 16 in training, all of which were sold by telegram on being advertised in the Indian papers. How many races and 'chases he had won is truthfully recorded in calendars and how many lakhs of rupees he had won in the process was confidentially but less accurately given out in every Club or Mess in India, when the subject of winnings came into the conversation. He was apt to be much tickled by these tall stories of his marvellous winnings and would say "No, I am afraid not, but I've had all my fun for nothing, including my

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pigsticking, and I've still got these four or five pretty useful hunters here at home."

Had this same ability and energy been devoted to graduating for the Staff College, he might have retired as a Field-Marshal. Instead he left as a Major and took the hounds in his own country. About two years before his death which occurred last year, he tried to persuade a young neighbour to run his horse in the hunt point-to-point, but was told the animal pulled too hard and jumped too erratically. His efforts to persuade any of the local Nimrods to ride the animal resulted in their straightway begging him to have them excused, whereupon he said "let me ride him for you," and proceeded to win on him at the ripe age of 65 or so, after having given up riding for a generation. "Dick" goes some way to prove my contention at the beginning of this article.

In the early nineties all soldier riders and indeed all amateurs were overshadowed by "Roddy Owen," a Fusilier officer, whose position as a gentleman rider has certainly never since been approached, and he was reported to be able to pick his mount in nearly every big race of the day, causing much bitterness among many of the professionals who felt they were being robbed of winning rides for big prizes. Every aspirant tried to model himself on Roddy's seat and methods, as was only natural with such a phenominal hero. He was tall, slight and well built for riding, and rode, or appeared to ride, as long as was humanly possible.

Arthur Yates once told me that trying to copy Roddy's long stirrup leathers had been the ruin of the riding of most of the soldier riders of that period. Possibly the same might since have been said, with equal truth, of Tod Sloane or George Duller and their short leathers. But perhaps to-day the happy medium has been attained in this very important detail. Roddy Owen's nearest rival was Percy Bewick, who rode very well at the time; he was saved the error of riding too long by the famous north country rider and trainer, Charlie Conyngham, who coached him, and was heard to roar at him after a school, "Paircy Beewick, Paircy Beewick, ye'll never ride, ye ride like a b——y soldier." The Army in those days rode, perhaps, in the same manner as it is reputed to

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have sworn in Flanders, viz.: "terribly." The present Equitation School at Weedon must be credited with having vastly improved the riding of officers as well as of other ranks. Arthur Yates did more than anyone to help young soldiers to learn to ride. He not only kept open house for them to come and ride gallops in company with two such professors as Will Sensier and Dollery, but was most sympathetic and wise in his advice to his pupils, and some of the schooling mornings there were as good fun as a meeting and still awaken many cherished memories.

Dalbiac (The Treasure), Jim Barry, "Boots" Beever, all made great names between the flags which are still remembered by their contemporaries, and I fancy "Boots" was a good deal of an artist at the game. The brothers Brown, "Gunner" and "Driver," belonged to an earlier period, but by all accounts kept up the Regimental reputation in their day, until the former was unfortunately killed by a fall in Sandown Park. I have mentioned only a few of the many whose names occur to me, but perhaps most of those best known in their respective times, but from the War back as far as one can remember there was ever a crop of keen gunners scrambling for a ride, on their own horse if lucky enough to have one, and if not then on anybody else's, not even overlooking a loose one on the course. Walwyn had been riding ten years before the War, Thorneycroft, Main, Gough, McMaster, Potter, Longmore, McGillycuddy, Tudor, Heneage, Gillson, Rotton, Blacker, Rich, Herbert, to name but a few who in their time could give a horse a fair chance to win.

"Ambush" may fairly claim a record of R.A. successes at the Grand Military, but he must not forget that there are fewer cavalry soldiers to-day and infinitely fewer young men of means who come into the Army for a few years before they settle down, and who used to find it fashionable to own a 'chaser or two. Moreover, super-tax, income-tax, the motor habit and the modern lure of the jazz band are all very hostile influences to steeplechasing, added to which the innumerable point-to-point meetings must certainly satisfy most of the available horses, and perhaps many of the riders as well. Again, the ranks of gentlemen riders, other than soldiers, are reduced by the new rules, beyond recognition, a most desirable

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change. In the old days many "Gentlemen" subsisted on riding. When Lindsay Gordon sang :—

'A gentleman rider !
Well I'm an outsider
But if he's a 'Gent'
Who the mischief's a 'Jock.' "

This class now ride as well but more honestly as "pros." and do not compete in amateur riders' races. As to the horses, "Pippin," in my humble opinion, if his present owner had got him as a four year old, would surely have been a good 'chaser—that he should have run as well as he has after such a misspent youth is a marvel. I saw him win an R.A. point-to-point and remarked volubly on his performance to a younger friend who must know more than I, and was quite hurt at his disparaging remarks about "Pippin." However, I felt I must retain my pig-headed opinion or consult an oculist at once, and "Pippin's" subsequent running saved me a two guinea fee. But there were horses of sorts before.

There can have been few more successful soldier owners of 'chasers than Colonel H. L. Powell, better known as "Paul," or perhaps better still as "Midshipmite" Powell. He seldom had more than two or three horses at a time, often only one, and yet he had "Bloodstone" and "Midshipmite" one after the other, both of them the absolute cracks of their day. "Bloodstone" only ran as a "Hunter," a very popular closed class under N.H. Rules of that day, started to make races for horses not good enough for open 'chases, but like all such affairs (*vide* modern point-to-point racing) the class gradually improved. I heard Arthur Nightingall say he wished he was going "to ride 'Bloodstone' in the National at anything under 12 stone next month." This was on the day he won the big hunter 'chase at Croydon. I once had the great treat of riding him in a gallop, and afterwards asked his trainer Gatland how far he would get beaten by a useful flat race handicap horse who was in his string at the time. He replied, with a twinkle in his eye, "perhaps the hunter might beat the race-horse." When his penalties had brought his weight up to 13 st. 7 lbs. he could still win, although as Gatland put it, "he had to sit up and jump under such an awful load." "Midshipmite" began his career with the Woolwich Drag as a four year old, and I feared had ended it also

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on the same occasion, when I helped to pull him off his back in a narrow deep ditch. He became and remained the best three-miler in England for many seasons and was perhaps unlucky not to win the National, although it was a good deal beyond his best distance. Anyhow the Regiment thought it was entitled to boast a useful horse in their time.

Blane, too, had a successful 'chaser in "Mizzand" who won a number of races in his time, I believe entirely by his remarkable jumping. Later he had "Comrade," a nailing little jumper too, who pulled pretty hard at home, causing Guy, who was Arthur Yates's strongest jockey, to remark when he pulled him up after a school, "The Capting what rides this one had better be fit." Luckily the selected "Capting" took precautions to keep fit and enjoyed several winning rides on him. Reggie Ward bought him from Blane and told me that "Comrade" taught him to ride, which was saying a good deal as he was then about as good as the professionals. On their first acquaintance the little horse got away with him, going to the post at Gatwick, and jumped most of the course the wrong way round without "half a fault."

Heygate was not racing for long at home but nearly all his horses used to win a 'chase of some sort after their hunting season, and he had quite a nice four year old in "Silver Lining" who won six or seven races off the reel before being beaten, and finished up with some valuable 'chases before going to the stud. Jack Porteous' euphonistically named "Killballysmash" was a nice old-fashioned sort. "Rocquefort," winner of the National and bought out of a Dublin side-car, was also owned by a Gunner, so was "Amphion," to mention only a few of the best of olden times.

There is another comparison between 'chasers of to-day and yesterday which interests me. I am credibly informed that since modern methods of riding came in that horses' mouths have benefitted greatly and can be in training without getting them spoilt or being taught to pull hard. This should at any rate be a great advantage to beginners whose main difficulty years ago was to be able to hold their mounts, which necessitated practice and considerable physical fitness. "Ambush" and his like may rest assured they earn by their successes a full measure of praise from the sur-

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viving old fogeys in the stand who wish them still more laurels in a manly pastime that demands the nerve to ride at fences as if they did not exist, a tight seat when things do not go smoothly and a good deal of horsemanship at times; and there are other things to it as well, besides hard condition which in turn demands healthy self denial. But their best friends will wish them to believe that " 'Chasing" may be a good slave though a bad master, and is best pursued in moderation. Without good management combined with good luck it may prove an expensive diversion. "Ambush's" financial survey as expressed to young Buggins I believe on the whole to be optimistic, in spite of the increased stakes and very generous place money. His suggested "Honest Plater" in training would need an exceptional countenance to get accepted as a trust investment in, let us say, a marriage settlement. However, Mr. "Cox & Co." must know more than either of us on this point, since he has probably had an involuntary interest in an amazing number of horses in his time; possibly the size of his stud helped him out, and many a sportsman must have felt comfort at the thought that a good winner had turned up elsewhere, when his own horse had disappointed the partnership.

All the same, among its devotees, many have attained to high places in their profession, since I must have bumped round the course with at least two Masters General of Ordnance—not perhaps holding that appointment at the moment—but their subsequent preferment goes to prove that equitation may meet its just reward. Many of us, too, can mind the time when one David Campbell won the National on "The Soarer," thereby gladdening the hearts of all soldier sportsmen. Even now as this goes to press many middle-aged ex-nimrods are rejoiced to read that "Sandy" Ruthven, one time a most graceful exponent between the flags, has been appointed Governor of South Australia.

To add a word on the subject of courses. Ambush seems to have definitely decided in favour of Sandown versus Aldershot, and as he speaks for the people most concerned I am not entitled to disagree, let alone contradict. But Aldershot used to be a very nice course. Halsey, that remarkable jockey who took to the flat after 'chasing, and rode second in the Derby the same year that he rode second in the National, once told me it was the most fair

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course in England. It has many other assets, such as availability of convenient date, freedom from obnoxious crowds of strangers, and accessibility to "other ranks" who like to see their officers ride. It is true that the Sandown fences have now been built up and much improved. I admit that the more experienced jockeys and horses in "The Cup" and "Ubique" put up a very good show there, but the Maiden Races try the beginners very high down the hill and round the next turn, and appear to devolve into a competition of courage and stamina in catching and remounting fallen horses. I hear that Aldershot is to have a meeting this March on the identical lines of the first R.A. meeting held there in 1893 which was a huge success. I hope history may repeat itself thereat.

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"DUNCAN" GOLD MEDAL ESSAY, 1927-28.

Since aerial operations in the future will assume greater importance than was experienced in the last great war, discuss the advisability of rendering all, or the bulk of artillery units of the field army capable of dealing with air targets. What changes would be entailed by the adoption of such a policy in regard to:–

(a) Organisation.
(b) Training.
(c) Equipment, including ammunition of the Royal Artillery.

BY CAPTAIN K. M. LOCH, M.C., R.A.

"CASSANDRA."

A CERTAIN learned judge was wont to startle his court by asking witnesses such questions as "Who is Mr. Lloyd George?" or "What is a bishop?" To the unthinking mind this might well be considered as a striking instance of the splendid isolation of the law from the main currents of everyday life. Further consideration would, however, point to method in this seeming judicial madness. We cannot argue a case without clear and accurate definition of the terms we use—we cannot remedy a disease without precise diagnosis of its symptoms.

In considering the extent to which artillery units of the field army can be used with advantage against aircraft, we will accordingly approach the matter by asking ourselves two apparently extremely naive questions—"What is an aeroplane?" and "What is A.A. gunnery?" Reviewing the problem from the standpoint of these two questions we may hope to be on a fair way to obtaining an impartial verdict. Before opening the case we must, however, start with certain premises:—

(1) To whatever extent we propose employing artillery units for A.A. purposes, economy must be a governing factor, both in respect to the equipments themselves and to any adjuncts we may require for shooting. Further, this

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economy must be in the sense of the only real economy, i.e. adequate return for effort in war as opposed to mere saving of money at the expense of efficiency.

(2) As a corollary to the need for economy we must accept our equipments more or less as they stand without any very drastic changes. Further, in our enthusiasm for promoting A.A. efficiency, we must not materially interfere with their primary rôle as land artillery.

(3) Given that our equipments lend themselves to employment as A.A. guns, judgment must be reserved as to the advisability of using them as such, pending the examination of the question from the standpoint of training.

What is an Aeroplane?

What is the aeroplane in its relationships to modern warfare, in other words, what is our problem from a tactical standpoint? A soldier is not called upon to formulate an opinion on matters philosophical. He need not attach himself either to the enthusiasts, who regard the advent of flying as a new dispensation, the beginning of a new chapter in evolution, or to the more conservative school, who regard it as the end of an old chapter and a gloomy one at that. He is merely concerned with the application of new ideas to his profession. Viewed from this comparatively simple standpoint, two main attributes of the aeroplane emerge with startling clearness. It is potentially the eye which can see behind the hill. It is the power which can strike directly at the back areas of the theatre of war, at the brain and stomach of the army. The air has thereby added another dimension to war and has become an ever open flank to land forces. The turning of this flank may in certain circumstances lead to disaster.

Air action is of two kinds, direct in the form of bombing and low flying machine gun attack, indirect in the form of reconnaissance and direction of artillery fire.

A further attribute is the speed, with which it can develop its activity and this is the fact which so sadly compromises our defensive measures.

Let us now consider the various forms of air activity in somewhat greater detail as regards their capacities and limitations.

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(a) *Reconnaissance.*

Aerial reconnaissance is of two main kinds, long distance and close reconnaissance. The former is of a strategic nature, information being required as regards large scale activity in the back areas. Such reconnaissance may rely largely on aerial photography and in general it will be carried out at high altitudes. The machine may, of course, descend for any specific purpose, when near its objective.

Close reconnaissance requires information of a more detailed nature and in general is complementary to that of the cavalry. As such it will be for the most part over the forward areas and carried out at medium or low altitudes according to the nature of the country.

(b) *The direction of artillery fire.*

The direction of artillery fire presupposes good observation of the target. This implies flying at comparatively low altitudes, especially in enclosed country. Obviously this form of activity will be very largely confined to the forward areas.

(c) *Bombing.*

In spite of the very great improvement in accuracy which has been made in recent years, owing to the complexity of the problem, bombing can only hope to produce material results against targets of considerable size. Moral effect is another question. At the same time, given suitable targets, the material effect of massed bombing is such as to call for all possible measures of defence. Where troops only are concerned, close attention to concealment and protective dispositions will go far to avoid offering suitable targets for bombing. In back areas and occasionally further forward, there will be points which cannot be protected by concealment or dispersion. It is against such points that intensive bombing will be directed and active means of defence are required.

A factor which has an important bearing on all A.A. measures is that the bombing of a small target tends to limit the attacker to definite lines of approach and success can only be obtained by the aeroplane coming within definite proximity to the target.

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As regards the moral effect, this may be expected to increase in proportion to the distance of the attack behind the line. Fighting troops in the forward areas should be less sensitive to moral depression.

(d) *Low flying attack.*

Low flying machine gun attacks, probably combined with bombing are likely to be effective against massed personnel, transport, etc. Good staff work and unit training can go far to reduce the occasions when conditions are favourable to such attacks, but these occasions will arise and counter measures will be necessary.

It should, however, be remembered that such attacks are difficult to stage at the right time and in the requisite strength. Further the numbers of aircraft likely to be available at the early stages of a campaign will be limited. The commander of an air force will be very chary of frittering away his strength on low flying attacks on anything but objectives of primary importance. A recent air force memorandum on the subject confines such activities in the main to attacks on a beaten army and to easing the pressure when our side is in difficulties.

We will now consider the tactical side of the defence measures against air attack. For this purpose we will separate operations into four general phases, the dividing line between which must of necessity be somewhat vague.

(i) Active operations, i.e. troops engaged in a battle of greater or lesser magnitude.

(ii) The reinforcement of the battle area, in which phase we may conveniently classify the approach march of an army.

(iii) Back area activities—railheads, dumps, supply columns, etc.

(iv) The landing at a base port and its subsequent maintenance. Although it lies outside the scope of this article, the main enemy air activity may, of course, be concentrated against the home capital and industrial areas. With the extra dimension added to war, the expression "in the field" has acquired an expanded significance.

(i) In the immediate battle zone, troops will be for the most part dispersed in fighting formations offering few opportunities

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for bombing aircraft or even low flying attack. Aerial activity will be confined in the main to intensive reconnaissance, often at low altitudes. In addition artillery machines will be active. On the other hand, for the reasons given above, bombing activity will be rare. In this zone there will usually be a considerable concentration of artillery, but for the most part in action and occupied on a definite land fire programme. Even such units as are in observation or readiness can hardly be diverted onto air targets. In this respect it must be realised that good A.A. gun positions are not easy to find in quantity. The main requirements are an all-round field of fire and, in the battle zone, cover from enemy land observation. These requirements are likely to prove disadvantageous to the land rôle of the guns in the immediate battle zone.

(ii) The protection of columns on the move—the approach march, etc.

Troops on the move are liable to enemy air action, both direct and indirect. Air reconnaissance will tend to be intensive and although troops may be concealed and adopt protective dispositions, places on the line of march, such as bridges, may afford a suitable objective for bombing or low flying attack. In this respect transport from an air point of view is the Achilles heel of an army on the move. The A.A. protection of troops on the move by guns can only be done by a system of picketting the routes, either by permanent pickets kept in one place throughout the duration of the move or by successive picketting. This implies moving up the guns as the march progresses. This latter method is more economical in guns, but to maintain this economy the protecting guns must be able to travel about three times as fast as the column which they are protecting. Thus the lorry-mounted A.A. gun units, with an average speed of seven miles per hour, can just protect an infantry column moving at 2½ miles per hour by keeping 25% of the guns out of action on the move. A mechanised force, moving at say eight miles per hour, will either have to have practically its whole route picketted or rely on its own means of A.A. protection (A.A. Lewis gun fire) and protective patrols of fighting aircraft, if available.

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During moves of large formations, artillery units will not be required for their land rôle except perhaps for protection against tanks and armoured cars. From a tactical standpoint there will thus be a quantity of artillery available for A.A. purposes and, further, it may be possible to a certain extent to site the guns for the dual rôle of anti-aircraft and anti-tank fire. In many cases, however, the requirements of the two rôles do not fit in satisfactorily. Another point which must be remembered is that batteries employed on A.A. picketting are liable to become widely separated from their parent units.

(iii) Back area defence.

Here again a number of artillery units may be available to provide the A.A. defence of important points. They will, however, tend to become even more widely separated from their formations with which they normally work. If the scope of the operations permits units being taken out to rest, they may be used for A.A. purposes. The duties are, however, arduous and likely to interfere with the process of recuperation to fit the unit for further fighting.

(iv) The base port, etc.

The base port, if within radius of enemy air action, will always be a tempting objective for bombing, especially during the landing of the force. During this landing we must make our maximum A.A. defensive effort. Artillery units should be landed as early as possible and the defences established. These units will presumably not be required for any other duty until the force advances and, tactically speaking, the defence of the base port is thus the phase when the employment of artillery units for A.A. purposes least interferes with their land rôle.

So far, however, no special mention has been made in this article of the means of air defence other than the guns. At the base port we are likely to find a complete A.A. installation, in which all the means of A.A. defence are mutually supporting each other. Whilst this mutual support should never be lost sight of in any phase of operations, it is of particular importance in such a case. Space does not permit of the development of this theme; suffice it to say that if aeroplanes, guns and lights are co-operating in

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defence, a somewhat higher standard of A.A. education is required of the gun units than when merely confining their efforts to shooting at any hostile machine in range. This point will be considered further when dealing with the training of A.A. units.

We can now sum up the problem from a tactical standpoint If artillery is performing its primary rôle of land fire it cannot conveniently be diverted to engage aerial targets. As we have seen, however, in the immediate battle zone, aerial activity will rarely assume the same intensity as in the areas further back. As a rule the centre of pressure of air activity will fluctuate between the base port and certain points in the back areas. A.A. measures in the battle zone are mainly required to hamper enemy reconnaissance and direction of artillery fire. This, however, is none the less an essential task of the A.A. gun. The problem is thus to cope with a number of individual machines as opposed to the massed formations which may be directed against targets elsewhere. The solution lies in a comparatively small number of guns definitely allotted to an A.A. rôle, plus small arm fire and, if the importance of the operation justifies it, the employment of fighting patrols.

At certain points in the back areas and in the protection of columns of troops, the strongest possible A.A. measures are called for. Unfortunately the employment of land artillery units for such purposes will tend to separate them from the formations to which they normally belong.

So important, however, may be the A.A. defence of these points behind the line that it may be incumbent on the higher command to spare as much artillery as possible for the purpose. An important consideration arises in this connection. The A.A. defences in a given area must be co-ordinated if satisfactory results are to be obtained. Although in the forward areas the general situation is so fluid that an A.A. unit can only carry out its rôle to the extent of affording protection to its immediate surroundings, in the back areas the defences must be more or less linked up and come under one commander. Whether ordinary land batteries or special A.A. guns are used, the principles governing their employment demand co-ordination of effort on the general lines laid down in the Manual of Air Defence.

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What is A.A. gunnery?

We can now put to ourselves our second question, "What is A.A. gunnery?" In other words examine the problem from a technical standpoint. We have dealt at some length with the tactical aspect and an important point which bears on the technical side as follows. With the exception of long distance reconnaissance machines and bombing attacks against very large targets, the bulk of flying in the field will tend to be at a height of rather under 12,000 feet than over. If carrying out a raid on a distinct objective, the raiders may seek safety during their journey by flying at a maximum ceiling, but in general terms, to influence what is happening on the ground they must come down to lower altitudes. As far then as range is concerned, we can consider an equipment capable of engaging a target up to 8,000 feet at say three miles ground range from it as a potentially valuable A.A. weapon. As will be shown an even smaller performance in this respect might be worthy of consideration.

A.A. gunnery.

The problem of A.A. gunnery in its essentials does not differ from that of engaging any moving target—it is purely a question of degree. Three main elements have to be determined, the present position of the target—where it is now—the future position where we hope to hit it and finally the gunnery elements to burst a shell at the future position. Owing to the speed of the target these factors must be capable of quick and virtually simultaneous solution.

The prediction of the future position depends on the assumption that the target will remain on a constant course at a constant speed during the time of flight of the shell and such time as may be necessary to make our calculations and get them carried out in terms of gun fire. The fact that this hypothesis may fail is often put forward as the basic fallacy of all A.A. gunnery. Admittedly, if the pilot were a free agent with nothing to do except avoid A.A. fire, the problem of A.A. gunnery would become one of determinism lying outside practical solution. Actually his duties in the field do not make a pilot altogether a free agent.

In considering the suitability of a given equipment for A.A. purposes it is obviously desirable to have as short a time of flight

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as possible for a given range, thereby increasing the chances of the straight course hypothesis holding good. In practice there are obviously very definite limitations to reducing the time of flight by increasing muzzle velocity, etc. A more fruitful line of research is to reduce the time wasted in calculations and drill. In passing be it noted that it is not necessary to introduce complications in ammunition by making special demands for A.A. purposes. In general terms the high explosive shell has proved itself as satisfactory as any of the many fancy types of shell suggested from time to time. An even fragmentation of, say, two to four ounces is desirable, but this does not materially detract from its value as a land shell. Against low flying attacks shrapnel is required. Reverting to the A.A. problem, we may accept the fact that if the A.A. gunner ensures straight course flying being punished, he will have justified his efforts up to the hilt. As will be shown the great stumbling block of A.A. gunnery is, and always has been, the determination of the present position.

Let us now consider our requirements to solve the A.A. problem. It will be convenient to deal with the subject under the following headings:—

(a) Methods of fire.
(b) Equipment.
(c) Instruments.

From these considerations we shall then be able to see to what degree we can employ land equipments for our purpose and as an immediate corollary the type of training required.

(a) *Methods of fire.*

The methods of fire usually employed in A.A. gunnery are known as Case I, Case II and Case III.

The ideal to be aimed at is clearly the continuous calculation of the future position, whereby the target is followed by a stream of fire, each shell being set to burst at the future position corresponding to the time at which the gun is fired. It will be seen that this method consists in effect of continuously predicting *a place for a given time.*

Case I is a direct method of fire in the sense that the gun layers follow the target both for line and elevation. The gun is directed on to the future line of sight by deflections calculated or estimated

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by the gun position officer and the instrument numbers. Tangent elevation (or as in all A.A. fire, fuze range) has also to be set on the gun by means of a dial. This fuze range dial must perforce be of a somewhat complicated nature, no plain scale reading will suffice. The method falls short of our ideal of continuous prediction in the sense that a burst of fire at the same fuze range is employed lasting some eight to ten seconds. Although this method covers certain errors in range it suffers from the disadvantage of what are known as "stale" deflections.

It is clear that with a rapidly-moving target in many cases the deflections can only be correct for one round of the burst of fire.

Case II is a similar method of fire to Case I, except that the fire is only direct for line, elevation or, to be more exact, future quadrant elevation, being applied to a quadrant elevation plate on the gun. Space does not permit going into the comparative accuracies of the two methods of firing. Suffice it to say that in certain portions of a given trajectory the Case II method is the more accurate one, in others it has grave errors.

It will be clear that if we intend using field equipments for A.A. purposes, using Case I, or Case II firing, we shall require in both cases a lateral deflection scale. With Case I we shall have also to consider the vertical movement of the target during the time of flight of the shell. This necessitates a vertical deflection scale. For A.A. purposes a vertical deflection scale should be capable of, say, 8° movement up and down, whilst the lateral scale requires of movement of, say, 12° right and left. As the Case II method of fire does not require vertical deflection to be set on the gun, nor, in fact, a layer for elevation, its disadvantages of accuracy are probably more than offset by the simplification in the design of equipment and in training. The mere fact, however, of the necessity of these scales is apt to prejudice the equipment from a land gunnery point of view.

Case III firing is the indirect method of fire. All the elements required for the continuous bombardment of the future position are calculated at a central instrument and passed to the guns in terms of bearing, quadrant elevation and fuze range. It is the most accurate form of A.A. fire and simplifies the work at the guns, no layers being required at the guns themselves. Further, one instru-

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ment can control the fire of a group of guns. Against these advantages the calculating instruments are expensive and complicated as are also the transmitting dials.

Further it is absolutely essential that the mountings and instruments should be accurately levelled. Up till now it has been generally accepted that Case III firing is not a method suited to the forward areas. In view, however, of the possibility of carrying all the instruments on a trailer, this view may have to be modified.

There is another method of fire which we have not yet dealt with. This may be described as the "*place for a time.*" It is in effect a passing point method. A prediction is made well ahead along the course of the target and the gun fired at the correct time for the shell and the aeroplane to arrive simultaneously at the future position. It is thus an intermittent form of Case III firing, inferior in fire effect, but simple to apply. It is a less satisfactory method than those previously described, but as will be shown it may have limited application for use with land equipments, not otherwise suitable for A.A. fire. At present its use is confined to barrage work—but more of this anon.

Equipments.

We are now in a position to see what equipments we want, and how far our present land equipments meet our requirements. There is a tendency to consider any gun capable of elevation and all round traverse as being generally suited to A.A. purposes. A moment's calculation will show that quite a normal aeroplane target will require elevation at a rate of about 15 minutes of angle per second and about double this rate of traverse. This is quite a conservative estimate. Further, the movements must be smooth if we are to get results.

For purposes of comparison it will now be convenient to outline the general properties of an ideal A.A. equipment.

The scope of this article does not permit the discussion of the best compromise between increased muzzle velocities and consequent longer range and reduced times of flight, increased weight of shell and hence greater radius of effect of burst as opposed to diminished rate of fire. Suffice it to say that where weight of equipment is no object, a gun of about 4″ to 5″ calibre, firing a shell

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of some 40 lbs. (combined weight of shell and cartridge) is probably the most satisfactory solution. Where the question of mobility arises we are limited in weight to a gun, the equivalent of the 3″ 20-cwt. A.A. gun firing a shell of, say, up to 20 lbs. As regards land equipments in the above respects we must accept them as they are.

This ideal equipment should possess the following features :—

(1) All round traverse and elevation up to 90°. The gears must be smooth working :

(2) The gun should be capable of use with either Case I or Case III firing. We can only justify Case II in the resultant simplification of equipment :

(3) The platform must give room for a detachment of seven (possibly six) working numbers round the gun. This implies considerable space for the breach and loading numbers who should be able to work freely in whatever direction and elevation the gun is firing. It also implies room for the range and deflection setters. Owing to the size of the deflections required, this is an important point.

(4) A high rate of fire and, consequent on this, ease of loading, at all angles of elevation. Apart from weight this would point to the desirability of a breech trunnion gun.

(5) Minimum time of flight for a given range.

There are naturally many other refinements, which experience would suggest, but the above five points will suffice for our purpose. We will now consider various land equipments in the field to see how far they approach our ideal by giving each what is admittedly a somewhat arbitrary figure of merit.

	Type.	*Figure of Merit.*
(a)	Ideal A.A. mobile gun equipped for Case III firing	10
(b)	Field gun on self-propelled mounting with all-round field of fire and using Case III	8
(c)	Ideal A.A. equipment using Case I or II ...	7
(d)	Field gun on a circular wheel platform, using Case III	6
(e)	Field gun of type B using Case I or II	5
(f)	Field gun on circular platform, using Case I or II	2
(g)	Equipment with 45° traverse using any method	1
(h)	Other equipments with less traverse	practically nil.

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The above figures are based on technical considerations. Tactical employment may cause us to modify our table. Let us review it for a moment in this light.

(b) *The field gun on self-propelled mounting.*

This equipment has a somewhat special tactical rôle in land fighting. Its use tends to keep it either in the forefront of battle or for sudden surprise fire effect. It is an expensive equipment and it is doubtful whether its land rôle will permit its use for A.A. purposes in the battle area. Its mobility, however, suits it for protecting columns on the march and if it is not required elsewhere it is a valuable asset in any back area defence. In its present stage of development it is far from being ideal for A.A. purposes in the sense of lack of steadiness and insufficient room for detachments. In fairness it may, however, be expected that the former disadvantage will be remedied. Thus if the tactical and technical factors are jointly considered this type of weapon can hardly pass as a serious rival to A.A. equipments specially designed for the purpose.

(d) The only other technical competitor with our ideal A.A. equipment is the field gun with a circular platform. Be it noted that the figure of merit shown against it presupposes suitable limits of elevation and a smooth all-round traverse. If this cannot be obtained the gun could only be used satisfactorily with the "time for place" method of fire, reducing it, we will say, to a third of its value. The advent of the tank apart from any question of A.A. fire will tend to cause all modern equipments to be fitted with a device for all-round traverse. Smooth traverse may not, therefore, be too much to ask. The outlook as regards other equipments is a gloomy one, were it not for one tactical consideration. The nature of the target from the air point of view may necessitate the attacker approaching it from certain definite lines and within certain definite limits—bridges, defiles, etc. Here wide limits of traverse are not required and practically any equipment could be sited to assist in the defence of such points if the importance of the defence justified it. Herein lies the possibilities of our *time for a place* or passing point method of fire.

From time to time attempts have been made to mount field

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guns on extemporised platforms, giving them all-round traverse and high elevation. Such platforms are only suited for defences of a more or less fixed nature, though given these conditions good results may be expected with Case III firing. It must be remembered that guns designed for low limits of elevation may not have suitable recoil arrangements for firing at high angles.

(c) *Instruments.*

We now come to the question of what exterior aids are required for the conduct of A.A. fire. Clearly, we need some means for determining the present position of the target. This in practice implies a height-finder. We further need a means of determining the "lead" required to deduce the future from the present position. Firstly, let us consider whether we can rely on judgment as opposed to instrumental methods for obtaining any of these results. Here, fortunately, we have the valuable experience of the war. Let us hark back to the days of complete guesswork shooting, say, the year 1916, In effect at this period machines had to be engaged by the light of nature. A.A. officers had an abundance of practice and it is fair to say that the achieved results were as good as could be expected and as good as anyone is likely to get in the future, unaided by instrumental means. The average number of rounds fired per aeroplane brought down was about 6,000, and if we take off 20% for the eccentricities of the equipments, ammunition, etc., then in use, we arrive at a figure of, say, 5,000 rounds per aeroplane. Now, by pure guesswork based on long experience, A.A. gunners were getting about 5% of rounds on the future line of sight. Therefore, we may assume that only about 1 in 250 rounds was correct for range. In other words, we may take it that guessing height and hence range is about ten times as difficult as the prediction of deflections. Admittedly, experience of the performance of various types of aircraft and their tactical habits may be of the greatest assistance, but in general terms whatever else we leave to chance on A.A. gunnery, we must have instrumental aids to finding the present position. In spite of all that has been written about prediction the fact remains that the vital problem of A.A. gunnery, as has been already remarked, was and is the satisfactory determination of the *present* position.

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We will not enter into a long dissertation on the merits of various height-finding instruments. Suffice it to say that if single station instruments of the range-finder type are used at least a three metre and preferably a longer base is necessary. This implies a costly and delicate instrument requiring suitable means of transport and, last but not least, lengthy training. It has been the general experience of A.A. gunners both at home and abroad that a good A.A. range-taker is a "rara avis" and once found should be kept, metaphorically speaking, in cotton wool, and not drafted away to some distant unit, where his artistry is not required. Long base two-station instruments are generally unsuitable in the field, but it is possible that what might be described as a short long base instrument of about 300 to 500 yards base might give the required results and be a feasible proposition in forward areas.

When we turn to the question of prediction we are still in difficulties. As has been demonstrated Case III or indirect firing stands out as the best method of fire and, as will be shown, is most adapted for use with land equipments. Case III firing requires a special predicting instrument and transmissions. If, on the other hand, we are able to use Case I or Case II, things are more encouraging.

The unaided eye-shot of experience should get 5% of his bursts on the line of sight, possibly certain "scratch" performers might get 10%. However, fortunately, certain aids to eyeshooting have been recently evolved whereby we may confidently hope that quite an ordinary performer will get 10% or more bursts correct for line. Further, these aids to eyeshooting are simple, portable and cheap. Better results are naturally to be expected from instrumental predictors. Whilst these should give the complete answer they are necessarily expensive and in a sense rather delicate. However, such expense is, so to speak, capital expenditure and the saving of ammunition soon covers the initial outlay. In peace time expense is admittedly an important factor, but we must beware of false economy—the A.A. problem has suffered greatly from quack nostrums of alleged cheapness.

A further instrumental requirement is a height fuze indicator. This instrument, given the height, will provide future fuze and, if required, quadrant elevation. As a separate instrument it is

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simple to use and inexpensive. In instrumental predictors it will form part of the instrument itself.

To sum up, the instrumental necessities for employing a land battery for A.A. purposes are as follows:—

(1) A height-finding instrument.
(2) A predictor or simple aid to eyeshooting.
(3) A height fuze indicator.

Training.

We have seen that both tactical and technical considerations impose certain limitations on the employment of land artillery units for A.A. purposes. Let us now see whether training problems in any way help us towards a final summing up of the case. We will take the case of the training required for a unit which is to be used on an independent A.A. rôle. As regards field units we must remember that they have a sufficiently complicated training before them to fit them for their land rôle, so our demands for A.A. purposes must be as few and simple as possible. The main difficulty of A.A. training in peace time is the provision of suitable targets for laying and training the instrumental numbers, etc. An actual aeroplane is the only really satisfactory target, though much of the preliminary training can be done with miniature ranges and similar devices. If a unit is situated near an aerodrome R.A.F. co-operation can be obtained, but with the best intentions in the world it is difficult for a squadron to provide sufficient co-operation (aeroplanes flying on definite courses, etc.) without interfering with its own training.[1] Miniature ranges require buildings of considerable size if they are to be of any real value. It has been accepted in principle that A.A. units should be stationed within easy reach of aerodromes.

Considering the training in detail as regards the battery personnel we arrive at the following conclusions.

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[1] The existing A.A. batteries, both regular and territorial, have until recently been concentrated at three places. The flying co-operation programme in the last two years has represented some 500 flying hours per year and the demands of units in this respect are on the increase. Naturally any number of units concentrated in a given area can benefit by the work of the same co-operating machine, but to provide, say, 100 flying hours per year for each artillery station at home and abroad would be a very formidable project.

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I. *The officers.*

These will naturally require a general knowledge of the A.A. problem, methods of fire, etc. This is not a difficult matter and a short course at the A.A. school with subsequent opportunities for carrying out training at the unit station should suffice. If we propose using Case I or II firing, they must also learn eyeshooting methods—not an insuperable difficulty but none too easy a proposition if the unit is not near an aerodrome.

II. *Instrumental numbers.*

(a) As previously explained, some form of range-finding is absolutely essential. Certain training devices are of assistance, but in general terms only long and continuous practice against aeroplane targets is likely to produce efficient results.

(b) If mechanical predictors are to be used, the training must be carried out over a considerable period. The training consists of two processes—laying the instrument and practising the deflection readers. The latter process can be carried out adequately with miniature targets.

III. *Gun numbers.*

The main difficulty here is training the layers, but be it noted Case III firing does away with this necessity. Deflection setting and following bearings and elevations as ordered are simple matters—very short training will suffice. The only other requirement is a rapid rate of fire at all elevations. This is merely an amplification of the duties of the breech and loading numbers at their ordinary drill. In general terms, therefore, the training of the gun detachments for A.A. purposes with the exception of laying is a matter which any battery should be able to undertake satisfactorily.

IV. *Identification of Aircraft.*

Identification of aircraft for A.A. gunners is a more complicated affair than merely identification for, say, putting a battery under cover when a machine is nearly overhead. It presupposes identification up to, say, 10,000 yards and that by type and appearance. No form of markings are sufficient guide. The method of describ-

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ing aircraft and identifying them is laid down in the A.A. manual. In the war the number of aircraft flying about enabled A.A. gunners to pick up the art of identification very quickly, and despite stories to the contrary there were very few cases of Allied machines being engaged in error. In peace time units may not have the opportunity of studying types of aircraft in any great numbers but much can be done with suitable silhouettes. However, it is not a form of training which is easy to apply to the regiment as a whole.

Conclusions.

We can now sum up for our final verdict.

Whether regarded from the standpoint of tactics, technical requirements, or training, it is clear that the backbone of our A.A. gun defence must be units armed with specially designed A.A. equipments with the addition of suitable calculating instruments and adequate facilities for training. No land firing equipments can really compete as regards efficiency. As we have seen, the closest rival of the A.A. gun is largely ruled out by its tactical rôle on land. The remainder fail to a greater or lesser degree from technical reasons.

The outlook, however, need not be so gloomy if we look upon land artillery equipments as a valuable supplement to the A.A. equipments allotted to a scheme of defence. In the battle zone we have seen that aerial activity will, for the most part, consist of reconnaissance and artillery machines, i.e. individual flying. With modern developments of A.A. gunnery it is fair to say that against the fire of quite a small number of A.A. guns, such flying will be hazardous to a degree. Further, as has been stated, if the situation justifies it we should employ fighting patrols. In such circumstances the co-operation of A.A. guns with fighting aircraft is a simple matter. Thus we see that in the one phase of operations where land artillery cannot conveniently be diverted to A.A. purposes, the problem of air defence can be solved by a comparatively small volume of well-directed fire, such, however as can only be produced by special A.A. guns with suitable accessories.

Against the potential massed air attacks behind the lines, considerable volume of fire is required, and we must call on land batteries to supplement our special A.A. equipments.

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We have seen that Case I firing is generally unsuitable to land equipments owing to the complications in sighting, if for no other reason.

Case II firing is a more attractive proposition. The sighting apparatus is simpler and more analogous to that already on the gun. Against both Case I and Case II firing there are, however, considerable objections on the score of training and also against the methods of fire themselves. We must not be led away by the ingenuity of many of the suggestions for overcoming the difficulties of the problem. We must be honest and face facts, neither Case I nor Case II firing have practical application to the ordinary land equipment.

Case III firing has, however, distinct possibilities, and herein lies, perhaps, the answer to our problem. Admitting that the assistance of land equipments is required in A.A. defence to supplement special A.A. units against large-scale air attack, in return for this assistance the special A.A. units must help the land batteries by providing certain of the elements required for A.A. fire, i.e. predictions for future position and height finding. If A.A. units can provide these factors, the remainder of the problem is quite capable of solution by land units without drastic alterations to equipment or special facilities for training in peace time.

The development of Case III firing offers us a means of making this a feasible proposition. We will thus confine our use of land equipments for A.A. purposes to two propositions and for this purpose we will divide our equipments into two classes:—

Class A—equipments having an all-round traverse and suitable elevation. These we will employ in important back area defences by using Case III fire.

Class B—equipments with small traverse. These we will use for barrage and "passing point" firing in the protection of places such as bridges, defiles, etc., in other words, using a limited Case III method of fire.

The employment of Class B equipments has naturally a limited application, but none the less an important one. If we can insure an adequate barrage against, say, the low flying attack on a bridge, we can then dispose our more suitable A.A. equipments to better advantage. This also applies to the question of the elevation of

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equipments. A limit of elevation of 45° is a grave disadvantage for A.A. purposes. Nevertheless, such equipments may be very valuable up to the limits of height imposed by such elevations. If we can increase our total volume of fire up to heights of, say, 6,000 feet by using land equipments, it will be of definite value to the defence.

Reverting now to the employment of Class A equipments—all we ask of the units is quick loading and firing and also training certain numbers to follow up bearings and elevations as shown on dials. The computation of the necessary predictions, etc., are to be carried out by personnel from A.A. units.

The following suggestion is put forward as being the lines on which we should proceed.

(1) Retain our present A.A. organisation but increase the number of specialists and instruments. Considerations of economy will not, however, permit of a large increase of peace establishments. Whether we contemplate using land guns for A.A. purposes or not, it is considered, however, that an A.A. battery on an eight gun basis should have at least four trained instrument detachments, even at the expense of the gun detachments. On expansion to war strength it is quite easy to absorb men into the gun detachments, especially with Case III firing.

If we insist on at least four instrument detachments per battery, we can then retain the principle of keeping the A.A. section as the tactical unit on a self-supporting basis. We should further be able in the majority of cases to use our A.A. guns in four-gun positions, thus having two spare instrument detachments to loan out to ground artillery units, allotted to assist in A.A. defence. Be it noted that the only changes involved in using our predictors with, say, 18 prs. would be a change in the computing drums in the instrument—no material change in drill is introduced. If we could afford a greater number of instrument detachments in peace time, so much the better, but leaving the question on a four detachment basis, each A.A. battery would be in a position to provide the necessary data to employ two land batteries on A.A. duties.

Going a little further into detail, the instrument detachment would consist of a heightfinder and a Case III predictor with personnel, say ten men in all. It is suggested that the predictor should

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be fitted with transmission for six guns. If, as seems probable, a combined heightfinder and predictor is evolved, the strength of the detachments could be proportionately reduced.

The general procedure would be as follows. Certain land batteries are allocated to the defence of an area. They would be sited so as to work in with the general scheme of defence, possibly given some special rôle to increase the fire power covering important points in the area. Each group of guns would be loaned a complete instrumental detachment and all that is needed would be to orientate the guns with the predictor. The writer makes no claim for originality in this respect. It was mooted by French A.A. experts as long ago as 1921.

Such then are the proposals for employing land artillery units for A.A. purposes. They may be considered as being conservative in not admitting possibilities of using direct methods of fire.

In these days of financial stringency it is a great temptation to blind oneself to the demerits of systems, which superficially may seem cheap and effective. We must, however, face facts and the experience of the war shows us the danger of relying on fire against aircraft without giving the A.A. gunner a chance.

It may be argued that Case III firing has not reached such a stage as to justify whole-hearted support. It is, however, significant that both at home and abroad the system is being fully investigated and the results already obtained are extremely promising. Experts abroad regard it as a method at least 100% advance on any other.

If we examine the objections put forward by opponents of this method of fire it will be found that the bulk of them can easily be overcome and the remainder are far outweighed by the advantage of the system.

The proposals may further seem to introduce a number of innovations, which are hard to accept unreservedly. Certain points in staff work arise in allocating units, arranging ammunition, etc., but these are minor difficulties. A battery commander may be chary of accepting responsibility for defence, whilst having to borrow, so to speak, another unit's brains. Here again goodwill and understanding will get over the difficulty—it has an analogy when taking over a battery position from another unit. The new unit expects to receive and benefit by all possible information from

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the old unit. There is one great difficulty in peace time which arises, namely, the question of A.A. practice for land batteries. Ordinary land ranges are not generally suitable for A.A. practice and the present camp at Watchet is fully occupied, apart from the expense of sending land batteries down there. The employment of Case III firing with loaned instrument detachments goes far to do away with the disadvantage of not firing. The land detachments are trained to work without gun shyness at their ordinary practice camp. It is suggested that one or two A.A. instrument detachments might be kept at the various camps to practice trial runs with the units without ammunition. Certain units could do this practice at peace stations, but at camp there will always be a number of aircraft available for such units as have no facilities for aircraft co-operation elsewhere.

In conclusion—the very formidable menace to modern armies introduced by the advent of flying calls for the employment of all means of air defence, both active and passive. As regards the share of the artillery, it is hoped that what has been said has demonstrated that special anti-aircraft units are essential. The remainder of the artillery can, in certain circumstances, afford valuable support to these A.A. units, but only in an adequate manner, when assisted by them in technical detail. Attractive as it may appear, the idea of the land artillery battery as an independent self-supporting A.A. unit is a snare and a delusion. On the other hand it is submitted that the value of the support which land artillery can afford in supplementing the fire of A.A. units fully justifies training and development on the lines indicated.

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THE NORTH-WEST FRONTIER.

A Lecture delivered at the Royal Artillery Institution, Tuesday, 7th February, 1928.

By Colonel H. Rowan-Robinson, C.M.G., D.S.O.

Lieut.-General Sir George MacMunn, K.C.B., K.C.S.I., D.S.O., Col. Comdt. R.A., in the Chair.

Chairman: Gentlemen, we are fortunate to-night in having Colonel Rowan-Robinson, a very distinguished officer of our Regiment, to lecture to us on this very old story of the North-West Frontier of India. He comes straight off the ice from the G.S.O. of the Advanced Division of Peshawar, where every problem is concentrated. He has also had the advantage of serving at Headquarters during the last few years, when he was very much concerned with the Frontier problem in India. This Frontier problem began nearly 90 years ago and, though it is as old as the hills, it is changing every day—a difficult problem. I will now ask Colonel Rowan-Robinson to give us his Lecture.

Colonel Rowan-Rowinson: The subject I am dealing with this evening is the control of the tribes in the North-West Frontier Province. I am omitting any reference to Baluchistan, as that agency, which covers the remainder of the frontier, is, relatively, so peaceful that it presents no serious military problem. Out of the various problems of Indian defence, I have chosen tribal control because it is one that is always with us, insistent in peace and vital in war; and most artillery officers who go to India for a long spell are now confronted with it in some form or other, not only those of the mountain artillery, but, with the improvement of communications to which I shall refer later, officers of other branches as well.

I will first draw your attention to a few of the features common to the whole of the North-West Frontier Province, and then deal separately with each military district concerned. The frontier with Afghanistan, known as the Durand line, runs, roughly, from the

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Pamirs near the Kilik pass along range after range of mountains to the Persian border. It forms the boundary of the North-West Frontier Province as far south as the Gomal river. To the south and east of the frontier at the foothills of these mountains runs the Administrative Border—the line up to which the Indian Government exercises full administrative control. Between the two lines lies an intricate mass of mountains inhabited by the semi-independent tribes, the problem of whose control is the subject of this lecture. They can produce some 300,000 to 400,000 of the finest guerilla fighters in the world—hardy, skilful and bold and now, for the most part, well-armed. It is necessary to keep these powerful tribes under control for two reasons: the first to protect inhabitants and property in the borderlands; and the second, to secure our communications and obviate the necessity for detaching forces for their subjection while we are fighting beyond the frontier. They are now under the nominal control of British political agents; but, actually in most places, except when troops are in occupation, it is unsafe to enter the territory unaccompanied by an army. On the other hand, they fully understand the meaning of the word "control" when it can be effectively exercised, as the following examples will show.

Last year the village of Jam declared war on the village of Banda. I may mention incidentally that each, prior to the declaration, had carried out an artillery practice camp with a muzzle-loading gun bought for the purpose. The war had gone on for some months with vast expenditure of ammunition on each side and some three or four casualties, when a stray bullet wounded one of our Sepoys belonging to the Fort of Jamrud. Both sides were then ordered to pay a fine of several thousand rupees and to stop fighting—which they did at once because they were under control, being close to a main road and to the Fort of Jamrud. The year before that, motor traffic was being interrupted by a tribal war across the Peshawar-Kohat road. Orders were therefore issued (and obeyed) that no fighting should take place between the hours of 10 a.m. and 4 p.m. and that the limits of fighting areas at other times should be denoted by red flags.

To the east of the province runs the Indus, unfordable and, owing to its width and repeated changes of course, unbridgeable

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by permanent bridges except at the gorges. Between the Indus and the administrative border are a number of fertile plains. The permanency of the tribal problem is due to the fact that under existing conditions the tribesman must raid from his barren mountains into these plains or starve. We have therefore to aim not only at effecting his military control but also at enabling him to earn a livelihood. The problem is thus largely economic.

A controversy that has long agitated military and political circles has been whether to adopt the "Close Border" or the "Forward" policy of control. Roughly speaking, the former implies the retention of all regular formations on our side of the administrative border in groups connected by good lateral communications and acting in support of irregular bodies of local militia located across the border. The main military objections to this policy are—firstly, that it does not solve the economic problem; secondly, that if there are general risings on the frontier, the local soldiery, especially if not closely supported by regulars, join in them and keep their arms; and thirdly, that it affords no real security to our line of communications in a big war. The "forward" policy in its extreme form implies the occupation of territory up to the Durand line, and full administrative control of the tribesmen. This is a perfectly logical policy but would be exceedingly expensive in troops, in the building of roads and barracks and in the transport of supplies. A compromise, but one of a distinctly "forward" nature, was initiated by Lord Rawlinson and has met with a great measure of success both from the military and economic points of view. It is the occupation in force strong enough for the provision of powerful mobile columns, of strategic points in the highlands in the heart of tribal territory, and the provision of roads to enable these columns to move rapidly about the country to suppress risings.

Another point of general interest to discuss before turning to the treatment of special areas, is the value of independent air action in frontier warfare. In certain cases there is no doubt its value is great: for example, a refractory tribe occupying a limited area rather distant from main communications and difficult therefore to reach on the ground except by the employment of large forces and masses of transport, can be reduced to submission at

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small cost by continuous and intensive bombing from a large number of 'planes. For a big expedition, however, in which operations extend over a wide area, where targets for destruction are very numerous, where caves are plentiful, where lashkars vanish to cover at sight of a 'plane, independent air action affords no promise of decisive results, though co-operative air action is invaluable. Actually air-control for the whole frontier is often advocated, but it would not solve the economic problem nor would it secure our communication in war.

The North-West Frontier Province contains three complete military districts—Peshawar, Kohat and Waziristan—and a part of the Rawal Pindi District, all under the control of the G.O.C. Northern Command. It is garrisoned by approximately three Divisions of covering troops assisted by a large variety of military and semi-military organisations which in peace are under civil control. I will now deal with the tasks special to each district.

Beginning at the right—RAWAL PINDI District, which is Cis-Indus has, in addition to troops located in the larger cantonments of Rawal Pindi and Jhelum, a mixed brigade at Abbottabad watching the Black Mountain area. But it is there rather for convenience of quartering than for strategic purposes, for the Hazaras are now quite peaceful and have been so for thirty years. Each of the other districts presents a remarkable military problem. The PESHAWAR District includes Chitral, the Peshawar Vale, where there is the best hunting outside the British Isles, and the Khyber Pass. It has some very curious features. These are the main line of road and railway running over the Indus at the Attock gorge to the Khyber and, between these two places, passing through the rich, well-watered plains surrounded by hills which are occupied by potential enemies intrenched in almost inaccessible countries—the Bunerwal, the Swati, the Mohmand, the Afridi, etc.—all subject to the suasion of a common fanatical force. The Khyber Pass itself, 20 miles long, contains two roads and a railway and has the dangerous Afridi tribe on the southern flank. Then there is the connection with Kohat running for 15 miles through tribal territory and for that distance wholly in tribal hands; and finally, the exposed position of the single battalion in Chitral, 100 miles from the nearest support by a track fit only for mule transport and closed for six months in the year.

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The tasks the district commander has to fulfil are in the main—the support of the civil power in safeguarding the inhabitants, the protection of the line of communications in the district and the covering of the concentration and forward movement of the field army. For these purposes he has at his disposal one cavalry brigade, and approximately 1½ divisions, the latter having rather less than the normal allotment of artillery and engineers. Three squadrons R.A.F. are also quartered in the district.

The steps taken to deal with the tasks mentioned are worthy of note: the excellent road and railway system branching out in every direction and enabling mobile columns from the main concentrations at Landi Kotal, Peshawar and Nowshera to be quickly despatched to all the scenes of probable action—Ambela where we fought the Bunerwals, Malakand where we fought the Swatis, and Shabkadr, more frequently a battle-ground than any other spot in the Empire; and an effective blockade-line of wire and blockhouses formerly established against the Mohmands between the gorges of the Swat and Kabul. These methods suffice for the protection of the inhabitants and of the line of communications. The defence of the Khyber Pass is now fully organised, and, at Landi Kotal, a mixed brigade has replaced the old Khyber Rifles. The Chitral situation arose originally out of Russian activity towards the Baroghil and Dora passes. It is not a situation that any soldier likes but it is less dangerous than it looks because the entrances from the north and west are difficult, because the country can support nothing beyond its own inhabitants, and because a conqueror of Chitral has to pass a very difficult country before he can reach India proper. Moreover relief can be effected *via* Gilgit as well as by Dir, and aircraft would now be able to render valuable aid.

You may notice that, although Peshawar District can fulfil the various duties assigned to it, it does not exercise any direct control of the tribes within tribal territory except in the immediate neighbourhood of the Khyber, Kohat and Malakand passes. You may also notice how important that control is, especially with regard to the Afridis and Mohmands who flank the Kabul road.

We now turn to the KOHAT District. This possesses one of the most peculiar military problems ever known. Its salient features are: connections by rail—Kohat with Rawal Pindi by broad-gauge

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over the Indus at Khushalgarh, and by narrow-gauge Kohat with Thal (60 miles); by road—with Peshawar (40 miles), with Waziristan (Kohat to Bannu 79 miles); a total line of communications by road and rail—Khushalgarh to Parachinar and on to the Peiwar Kotal, the route by which Lord Roberts advanced to Kabul—of 160 miles; a country of length without breadth flanked throughout its huge length on both sides by potentially hostile tribes; throwing forward into Afghan territory a salient protected by no natural obstacles on the south and west; a seat of local government (Parachinar) right forward in the salient and a magnificent aerodrome that cost many lakhs half-way up it, both offering tempting bait for attack. Fortunately, however, there are some alleviations to the serious problem of holding such a district with a strength which only amounts to 1½ brigades and a squadron of 'planes in peace.

In the first place, the inhabitants of the salient, which furnish a militia garrison there, and some tribes on the northern flank, are of the Shiah persuasion; and they regard us as their natural protectors against the more warlike and vastly more numerous adherents to Sunni doctrines. In the second place, the sandwiching of Kohat between the Peshawar and Waziristan districts affords it a certain moral support. And, thirdly, the direction of the Kohat-Peshawar road is a useful deterrent to hostile action, for it enables a mobile column to arrive suddenly in the heart of a rich tribal area.

The task of the district is purely protective. It has to guard the salient, with its aerodrome and seat of government, against Afghan irruptions and to prevent tribal raids into the rich river valleys. Its method of fulfilling its task is to keep the main body—a mixed brigade—at Kohat, whence it can move by road towards Peshawar or Bannu or by rail to Thal—to keep one battalion on the Samana as a protection against the Orakzai tribe and one battalion at the important strategic point of Thal. These dispositions are of peculiar interest in view of the fact that during the third Afghan war, the whole of our plan of campaign was thrown out of gear on account of an Afghan attack on Thal, which caused us to divert forces, intended for an offensive movement from Dakka, to the relief of Thal. We had in that case taken inadequate measures for security before launching an offensive. This is a military problem which every commander has to face at times.

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There are never enough troops available to meet every possible contingency. If he employs too many troops on security duties he will not have enough for his offensive. On the other hand, the exposure of an important point to an enemy blow may ruin his plan of campaign. It is where a careful appreciation of the situation is of such value.

A word at this point on the relation between "numbers" and "time" in our Indian problems. Because, when we had to fight in 1919, our army was but half-trained, we are inclined to place an excessive value on the former and to pay too little regard to the latter. "Get there quickly and strike" is more important by far in the East than in the West. The quick and sudden arrival of a mobile column, however small, has a dissipating effect on enemy forces and acts as a powerful deterrent to rebellion. It nips trouble in the bud; whereas, by the time an army has been mobilised, and has plodded slowly to its objective, the conflagration may have spread widely, and many months of costly war may be needed for its extermination.

WAZIRISTAN possesses a problem wholly distinct from that of the other two districts. It lies largely in a mass of desolate mountains between and apart from the two great highways into India—the Khyber and the Bolan. It could indeed itself be invaded by the Tochi and the Gomal valleys, but only by small forces equipped with pack transport. The district commander has an immediate and concrete problem to deal with—the control of two of the boldest and most skilful fighting tribes on the frontier—the Mahsuds and Wazirs—to ensure that they do not raid into the plains, and to hold them in an iron grip should we be engaged in hostilities in Afghanistan. It is here that Lord Rawlinson's policy has proved most effective. The bulk of our troops were cantoned, just as were those of our predecessors—the Sikhs—along the foothills and in the hot, unhealthy valleys. Now the greater part of the troops are quartered on a high and healthy plateau on the line of junction of the two great tribes and at the head of numerous valleys which they inhabit. 6″ howitzers are within easy range of the Mahsud capital and the fact that a shot fired into camp may be answered by a couple of 6″ shell bursting in Makin has a deterrent effect on the activities of snipers. The country once so inaccessible has

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now been penetrated by an excellent system of roads, the main feature of which is the circular road from Bannu along the Tochi valley, thence through Razmak and Jandola to Dera Ismail Khan.

The troops, numbering about a division, are distributed on a simple and effective plan, that of a strong centre and two light wings, each having mobile columns, the wings strong enough to act independently for a period and the centre equal by its strength and its mobility to undertake any punitive expedition either from its normal base or from either flank at will. The Mahsuds and Wazirs have an accurate military sense, and they recognise that the game is up. Our most redoubtable opponents on the frontier, they have given no trouble since 1923 and are fast taking to trade and motor-cars.

That completes the situation in the district as it is or will be in the immediate future. A couple of years on we may see a considerable change, but all in the same direction and principally in the extension of communications. Thus the domination of the Mahsuds will be completed by the occupation of Wana, by the building of a road to that point and the continuation of the road in circular form through Kaniguram to Razmak. Then the district commander will be able to deal with almost any problem in the country with forces requiring pack transport only for one day's radius of action off a metalled road. When that stage is reached it is possible the tribes may accept disarmament. An even more important communication, for it remedies what has hitherto been our principal weakness in Waziristan, is the bridge that is about to be built at Kalabagh to carry the broad-gauge railway over the Indus. Then a road will shortly join up Idak and Thal facilitating combination with Kohat district greatly and helping somewhat to solve the problem of the weak salient there; and another road is being constructed from Dera Ismail Khan to the Zhob, thus completing the chain of lateral communication along the whole frontier.

This extension of communications is now part of a settled policy in the Province—a policy partly forced upon us because of the tremendous difficulty in moving a modern army with its endless requirements by pack transport and partly undertaken with a view to tribal control and civilisation. Thus, whenever we have to punish a tribe, we shall move by a road made as we proceed, and

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that road will ever afterwards enable us to dominate the country either by enabling a garrison to be kept there or a punitive column to be quickly moved into it. By this process it is hoped that we shall eventually succeed in eliminating the greatest of our permanent troubles in India and at the same time be able to undertake, if required, a forward movement beyond the frontier confident in the security of our communications.

There are, however, other principles besides "Security" to be borne in mind—those of "Economy of Force" and the "Maintenance of the Objective." Say, for example, we occupy a certain position in the centre of another tract of unadministered tribal territory. Are we to station a strong mixed brigade in this location as at Razmak? If so, where are the troops to come from? Certainly no addition will be made to the Army in India. If we take them from Peshawar or Nowshera we shall be short-handed for dealing with refractory Mohmands or Bunerwals or for an emergency relief of Chitral. If we take them from Cis-Indus, we shall either have to break up our Field Army or reduce our internal security troops below safety dimensions. Again, when troops reach these new frontier stations, they will need solid barracks; and bricks and mortar have an unpleasant habit of determining policy long after the policy which brought them into being has become obsolete. And one more danger—when the policy is in full swing and we have brigades, say, at Wana, Razmak, Thal, Bagh, Landi Kotal and Nahaki, what will happen in the event of a great war across the frontier. We shall have taken all the fluidity out of our army system. If we leave them there we shall be short of troops for the main offensive; and it would be absurd to be held up in our principal theatre for lack of troops while three or four divisions of covering troops were sitting idle. Yet, if we withdraw them at a time of strain from their dominating positions and expose their bricks and mortar to destruction, we shall be tempting the tribesmen out of their controlled habits. These questions will have to be solved largely by compromise; but the solution must be worked out now and not when the emergency arises. The mechanisation of the British troops in India may be of considerable assistance in this respect. The bulk of the British troops are employed on internal security duties. Their mechanisation will render them

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much more efficient for these duties and thus enable a number of units to be transferred to the Field Army or Covering Troops.

After building roads and occupying forward areas, it would be possible to hold the latter by well-organised militia led by British officers and recruited from distant tribes, provided the militia could be assured of rapid support in case of attack. Such support could, if required, be rendered by aeroplanes and by the mechanised units made available by the mechanisation of the British army in India. The aeroplanes and mechanised units, being grouped cis-border, would also be available for warfare beyond the frontier should the attitude of the tribes permit. This system when in full swing would be a mixture of air control with all former methods, the latter being reinforced and quickened by the introduction of mechanical units.

To summarise. Peace on the frontier which has always been our aim will only be attained when we shall have secured tribal control and solved the economic problem of the tribesman. Control of the tribes is not only required in peace but is essential in war for the security of our line of communications and to obviate the necessity of having to divert forces which are required in the main theatre to deal with them. Generally speaking it may be said that the problem is in process of solution in each of the three military districts concerned; that it has been solved to a great extent in Waziristan, that in the Peshawar district the flanks of the Khyber Pass still require attention, and that, in the Kohat district, the situation in the salient is not wholly satisfactory.

The system introduced by Lord Rawlinson has proved most effective, and real control is now exercised where it is directly applied. There is the danger, however, if this system is further pursued, that too great a portion of our Army in India may be locked up and not be available for major operations. It is suggested that the mechanisation of the British army in India—which is desirable for many other reasons—would, combined with an extension of road-building, assist greatly in the solution of this problem.

CHAIRMAN: Gentlemen, I venture to call on The Master General of the Ordnance, who is with us to-night and who naturally knows what the War Office has in its mind in generally backing up in India the defence of the Frontier, to tell us something of their

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view on the problem of the land which lies behind the Frontier and what we have got to face.

GENERAL SIR WEBB GILLMAN: Gentlemen, Colonel Rowan-Robinson has told you about some of the problems with which we are faced on the North-West Frontier of India. As one of the potential danger spots of the Empire, I would recommend you to study very thoroughly this frontier, about which you have had so interesting a lecture to-night, not only topographically but also ethnologically. We are looking forward to the Amir's visit with great interest, and we hope that as an outcome of it the relations between us and the Afghans will become increasingly friendly.

CHAIRMAN: Would anybody here like to make any remarks? There are a good many people here who know the Frontier, mountain gunners and others.

MAJOR LITTLE: There is one thing I would like to have cleared up. The lecturer again advocated putting the militia up in the front line. When I was up in Waziristan a few years ago I felt that the militia distinctly looked upon it as unfair that they should be put in the front line. They are not regular troops, and they are not anything like as well armed as regulars. If, as the lecturer suggested, they mechanise part of the internal security troops, I think they might be able to find extra troops to carry out the same policy as they have done in Waziristan to make our frontier more secure. It is really reverting to the old Curzon policy which crashed in 1919. Even then I think the intention was to have troops to support them, and of course in 1919 they were not there, and it might happen again. If that is so, I think the militia most certainly will go again. It struck me that they had a feeling it was unfair to stick them in the front line, and that that was the job of the regular troops. They were quite willing to help them, but they did not think it at all fair to put them in front.

COLONEL ROWAN-ROBINSON: As regards that point, I do not think at the present moment you will find that the tribal militia are anxious to keep a back position. They are exceedingly keen; they are very well armed now; and they are well drilled. They are in particularly good and well-built forts, and they are,

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I believe, perfectly happy there. The great difference between the former employment and the employment I have been suggesting is that in the latter case they would be assured of immediate support. Several cases have occurred where they have failed. For instance, at Wana and in the Khyber. In the latter case in 1897, they were perfectly ready and willing to stay on if only we had got up in time. But it is this lack of immediate support that has been the point on which they have crashed up to now; at least, that is my own personal opinion.

COLONEL SALT: Can we give them immediate support at Wana now?

COLONEL ROWAN-ROBINSON: We have got at present no tribal militia up at Wana. Next year we may push a whole brigade to Wana and make a road up there, but if it is thought a mistake to push so many regular troops right forward and therefore to be unable to use them for an offensive afterwards, then one might have tribal militia up there and be able to support them quickly from Jandola.

COLONEL SALT: Is there any idea of pushing the administrative boundary up to the Durand Line?

COLONEL ROWAN-ROBINSON: I think the administrative line should go automatically as far forward as we exercise real control. There is nothing on paper, I believe, about pushing it forward, but in Waziristan and in the Khyber, we are exercising control in places far beyond the administrative boundary.

GENERAL WILLIS: Have there been any cases of tampering with roads by these tribesmen?

COLONEL ROWAN-ROBINSON: No. They like the roads, and they use them so much for motor-cars themselves. If you go from Thal to Parachinar, for instance, it is like Piccadilly; you meet dozens of motor cars.

GENERAL WILLIS: That is because we are at peace with them at present, but from experiences elsewhere it would appear to be

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an easy matter to cut these roads away on steep kud sides, which would delay mechanised transport for a very considerable time.

COLONEL ROWAN-ROBINSON: Yes, it is a danger. But there are two things which apparently they do not interfere with very much and which we have always taken chances about on the frontier: one is water, and the other is roads. They have not tampered with them yet; whether they will or not, I do not know.

COLONEL HILL: The lecturer has drawn particular attention to a very special characteristic of operations in the North-West Frontier, and that is the long lines of communications that are involved. The defence of these lines and the protection of vulnerable points such at depots at Peshawar and important railway bridges are matters of considerable moment. In the near future it is to be expected that frontier problems will be further complicated by the presence of hostile air forces. Should this occur, the present lack of A.A. guns and searchlights in India will be felt acutely.

There are, of course, a number of R.A.F. units already there, and these are being reinforced by two more squadrons. But, as it is almost impossible to have a complete system of defensive patrols in the air at all hours of the day—a system that would be highly uneconomic and totally opposed to R.A.F. principles—it is of primary importance that A.A. guns should be available for purely defensive purposes. It is sometimes considered that very large numbers of A.A. guns and searchlights are an absolute necessity. Personally, I do not hold that view. I fully agree that the more A.A. guns and searchlights there are, the stronger will be the defence. But I hold the opinion very strongly that if large numbers are not available, much can be done with limited resources.

To take an extreme case, suppose it was required to defend an important centre such as Peshawar, and the only available resources were two A.A. guns and four searchlights; the question at once arises what is the value of an A.A. defence on such a small scale. The answer to this question is best arrived at by considering the value of this somewhat meagre A.A. defence in comparison with no A.A. defence at all. If there are no A.A. guns and no search-

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lights, a hostile raider at night can carry out a leisurely reconnaissance and thereby definitely identify certain specific objectives, such as a petrol dump, and then, by a deliberate system of bombing make fairly sure of dropping his bombs to the best advantage. If, however, there are two A.A. guns and four searchlights, his reconnaissance is likely to be hurried, and, as he will be momentarily expecting to be picked up in the beam and attacked by A.A. gun fire, he will probably unload his bombs with greater regard for rapidity than for accuracy.

No A.A. defence, however powerful, can absolutely prevent a locality from being bombed, but even a light A.A. defence can do much to reduce the chances of really effective bombing, especially when a small target such as a railway bridge is the objective. The stronger the A.A. defences are the smaller are the chances of raiders succeeding in anything but promiscuous bombing. In addition to the actual losses that may or may not be inflicted on the raiders themselves, the question of *morale* has to be considered. Nothing is so desperately depressing as to be bombed, and to know that no effort is being made to hit back. I can imagine that if a place like Peshawar were bombed, and no A.A. guns were available to respond with an instant vigorous counter attack, the effect on the populace would be devastating and might lead to far-reaching results throughout the whole of India. The effect of such a raid would be out of all proportion to the actual casualties inflicted.

The need of A.A. guns and searchlights in India is undoubtedly a pressing one. And it should be borne in mind that A.A. guns and searchlights can, by means of a good system of communication, add very greatly to the effective value of the R.A.F. units already there. The following remark by Admiral Mahan although actually referring to coast defence is even more applicable to air defence, "Postponement of precaution is the sure road to panic in emergency."

CHAIRMAN: Well, gentlemen, before I ask you very cordially to thank the lecturer, I will venture, if I may for a few moments, to endeavour to dot some of the i's and cross the t's. First of all, there is an interesting minor point which may amuse you. We have heard a lot about the motor cars which the tribesmen now use. Of course they do not go four or five in a motor car, but they go

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ten in a motor car; and it is very incommoding to have ten rifles and ten bandoliers so the tendency is to leave your rifle at home. Two rifles are now considered to be quite enough. Then, mind you, raiding motor transport is not very popular. You do not get much. You capture two or three lorries. How are you going to get the stuff away into the mountains? When you have twenty camels or a couple of dozen mules, you just take them with you. But in a raid on a motor lorry the loot is not much good to you. The rescue party will be out in an hour probably; so that alone the motor road is making the raiding of transport rather less popular. All sorts of curious little things come in. Sir Webb Gillman was saying as much as he could fairly do on this very difficult question of Afghanistan, but it is well worth remembering that our policy towards Afghanistan has never changed. We went into Afghanistan in 1839; we went in there in 1878 and 1879; and we are following the same policy now of making a strong, friendly Afghanistan as a buffer state between India and Russia, who have been coming steadily up towards the Oxus, whether it is Imperial Russia or whether it is Soviet Russia. Opposite you there is a picture[1] of the first Afghan War; an incident in that terrible disaster, the destruction of the force in Kabul. In that retreat from Kabul the Bengal Horse Artillery was always the rallying point. I think that represents the last gun trying to break through. Our artillerymen in those days had their brass helmets, their panther skin pugarees, leather jack boots and their jackets—not the sort of thing you would expect to see in Afghanistan. That disaster arose in pursuit of this same policy—a strong Afghanistan.

The cycle of armament is interesting to observe. In the days of the smooth bore the long ranging mountaineer's *jezail* shot twice as far as the regulation musket in the first Afghan War. Gradually, as the muzzle loading Enfield rifle came in, we began to get the best of the game with the hand gun. We had the Snider, he had the Enfield. When we had the Martini, he had the Snider. In 1897, when there was the great burst of frontier trouble, the British troops had the Lee-Enfield and the tribesmen mainly had the

[1] Afghan War, 1841-42. A gun of 1st Troop, 1st Brigade, Horse Artillery (now "F" Battery, R.H.A.), commanded by Sergeant Mulhall, was captured by Afghans on November 23rd, 1841. The picture shows the attempt to withdraw the gun.

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Martini Henry; but now the present situation is really due to the fact that all the rifles and ammunition of the world have been lying derelict. When the Turkish Army cleared away from the vicinity of Kut, it left behind it thousands of rifles and millions of rounds of ammunition. The Arab tribes undoubtedly traded away those Turkish rifles, large numbers of them, across the border. Not only that, but there were all the rifles that were left derelict when the Russian troops broke up. All the odd war time rifles and ammunition of the world are now traded up into Central Asia, Afghanistan and the Frontier, and that is why every lad has a rifle and stacks of ammunition. It has entirely altered the military problem. Now turning aside from the modern state of things, it has always intrigued me and has interested me—and it should interest you—to realise who are these tribes and why are they there? It is an old frontier. Alexander came down from Kabul into the Peshawar Valley. How is it that these tribes have always stayed like this and who are they? When we first went to Delhi in 1803, Afghanistan then came practically down to the Sutlej. Mooltan was an Afghan province; Sind was an Afghan province; Kashmir was an Afghan province; Peshawar was an Afghan province up to 1837, the year before we were passing through it. The invaders of India—Macedonian, Turk, Afghan—always let these tribes alone who dwelt in the tumbled hills between the Kabul—Kandahar road and the Indus. There have been certain great routes that came through these hills. The Khyber was never a great trading or invading route though people often imagine it was. The great routes down to India came down from Kandahar and were more practicable, then they cut across the riverine flats of the Derajat. Two well-known passes were the Vihoa and the Harrand, blocked by enormous forts at Harrand and Mangrota in Sikh times. These were the great invaders' route from Kandahar, and then on to Lahore via Mooltan. The Khyber was hardly touched, because the Afridis have always been a nuisance. The Alexandrine historians called them *Aparoetae*, which is exactly how the Afridi of this day pronounces his own name. It is the fashion of all frontier tribesmen to connect themselves with the Afghan race proper, who claim descent from Saul; who call themselves the children of Israel; all local tribes hitch themselves on to the *Pucktan Wali*, with a great

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genealogy boosted up by a bogus college of heralds. As a matter of fact, most of these people are undoubtedly the ordinary Aryans of the plains of India; but when the Aryan invasion slowly filtered down through Afghanistan many Rajputs on the way to India remained and occupied some of these fertile valleys, and living in that sturdy climate they became more and more rugged and more and more hardy, like all mountaineers do. In comparatively modern times they adopted Islam; but to that time, all up here was first a Hindoo country, then a Buddhist country and then a Hindoo country again until Islam came to the hills. The Afridis, the Waziris, and a lot of these tribes are akin to the Dogra mountaineers, the Hindoo Rajputs. Ethnologically these are very much the same sort of people as the Rajputs who have developed under different conditions. As they were ill folk to tackle, the great invaders let them alone; they guarded only the routes and boxed them up in the hills, in the same way as we do and closed the same raiders' routes as we do. I know many remains of Graeco-Bactrian posts all along the frontier within a quarter of a mile of a British post. So the problem of these wild devils is age old, and not unlike the problem which made Hadrian build his wall across North Britain. If Afghanistan, as it really promises to do, is going to adopt a semi-western civilisation, then the infiltration of civilisation to these gentlemen is going to come very much quicker, which is what the young King of Afghanistan is aiming at, and all these tribes will be cut off on both sides. Up to now they have had all the wilds behind them to fall back upon. These remarks are only by the way, as a fringe to a most interesting lecture.

There is one point I would like young officers here who do not know India to remember, and that is that service on the frontier is as delightful and romantic a thing now as ever it was, if you like a hard life; your shooting is hard; your work is hard; the climate is hard; but it is the most romantic thing, and if you are in the mountain artillery, to belong to a club which numbers forty ordnance mules as fellow members will be a happy remembrance all your life.

Gentlemen, I will now ask you to give by acclamation a most cordial vote of thanks to Colonel Rowan-Robinson for his very important and most interesting lecture.

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SPEEDING UP AND SIMPLIFYING "SURVEY."

By Captain J. O. M. Ashley, R.A.

(Note.—*As this article contains suggestions affecting existing establishments and introduces various proposals of a debatable nature, it may be advisable to draw attention to the fact that the opinions expressed below represent the personal views of the writer, and therefore must not be taken as an indication that the authorities concerned are contemplating the adoption of any such alterations to present procedure.*—J.O.M.A.)

I. Introductory.

THE greatest enemy of predicted shooting at the present moment is time—the time that must be allowed for the preliminary survey operations. Any modifications, therefore, of methods or of instruments that will help to lessen the delay will diminish the dislike with which "survey" is regarded in some quarters, and strengthen the faith in its usefulness which is spreading gradually through the Regiment.

As far as the artillery brigade is concerned, survey aims at connecting the gun to its target, and there is no dividing line between this form of survey and gunnery; in fact the former is part of the latter. The brigade surveyor need only work to a standard of accuracy just sufficiently high for the particular object in view, and therefore should use no unnecessarily complicated instruments or calculations; a good knowledge of survey on the part of the officer in charge will enable him to appreciate the liberties which he may safely take and so avoid needless labour and waste of time. The survey company, however, have to work on a different plane; they are compelled to keep a high standard of accuracy, as they operate over a far larger area (the area over which their corps may move), and may have to carry forward a framework of fixed points over distances of many miles. Any errors which they allow to creep in will increase as the distances grow greater, and in time may cause serious trouble. The brigade surveyors make use of two or more of these points in their own

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local operations in order that their results may fit in with the general system of reference.

Before going on to suggest possible variations in existing practice, it may be as well to sketch out the way in which "survey" enters into the method of getting the gun on to the target under different circumstances. The method adopted in preparing to fire the first round depends primarily on the time available, and secondly on the efficiency and activity of the enemy. If one is in tropical Africa, engaged against natives armed with nothing that can hurt at a range of a couple of hundred yards, the gun can be moved close up and fired point blank at the stockade or whatever the target happens to be. Not even the most ardent surveyor would think in terms of co-ordinates under those conditions, nor would anyone dream of producing a field plotter or aiming posts. On another occasion one may be fighting against a somewhat more efficient enemy—for example, native troops under European officers. There is, perhaps, just as little time to spare, but one cannot take such liberties; then the aiming posts or the T.O.B. come into their own. The T.O.B. is really the beginning of predicted shooting, although no co-ordinates are involved; certain observations are made, and by means of them a triangle is solved which provides the required line and range. Is there any real difference between this and a rough "survey" operation? Admittedly no calculation takes place, but nor is one necessarily part of the latter.

Again the enemy's aggressive tactics or the topography may compel the battery to occupy a position far in rear and out of sight of the area where observation posts will have to be located; then the battery commander is faced with having either to shoot "off the map", or to obtain the co-ordinates of his guns and the targets in order to arrive at the line and range by calculation. Finally, the commander of the force may decide that he will make a surprise attack, and, in order that his intentions may not be given away, lays down that no previous artillery registration is to take place; under these conditions surveyors must make ready for accurate predicted shooting, and they must be allowed sufficient time to do so. There is no other way.

Other conditions may force the same methods on the gunners; the enemy may have a highly developed counter-battery organisa-

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tion—and no battery is easier to locate than one which is firing a few ranging rounds at comparatively long intervals. Or he may have commanding observation over the battery areas, so that any movement or firing before the critical moment will be noted by him and the guns neutralised when their help is most needed.

Generally speaking a knowledge of survey enables one to use to the best advantage the interval between the occupation of a position and the opening of fire, by indicating the method which will give the most accurate values for line and range obtainable in the time at one's disposal.

II. Possible modifications in tactics.

Under the present organisation it is laid down that the divisional survey sub-sections of the survey company are to aim at providing bearing pickets in brigade and observation post areas and fixing control points, and, where possible, a number of targets, particularly distant ones. The brigade personnel are then to fix their battery positions and observation posts by means of these bearing pickets, and locate such additional targets as their own brigade may be called upon to engage. Any initiative in the form of starting an arbitrary grid is not generally approved, except by direction of the C.R.A., through the officer commanding the survey company, or, in the case of a division acting on its own, through the officer in charge of the survey sub-section. Thus the brigade surveyors cannot begin their operations until the survey company personnel have marked the sites for the bearing pickets, and are unable to work out the co-ordinates of the positions of their batteries and observation posts until the co-ordinates of these pickets have been received. Such limitation of the use of the arbitrary grid appears to result in the divorce of the employment of survey methods from the normal gunnery tactics of the brigade, and make it dependent on the progress of the survey company.

Survey applied to gunnery is bound to the same principles as survey applied to the making of maps; but modifications of these principles are necessary in the former case, owing to the most important difference that this is survey carried out against time and great accuracy is useless if results are not ready when required. In map-making survey the normal procedure is for a triangulation

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of a very high order of accuracy to be observed over the whole of the area concerned; points in this framework will be probably from fifteen to twenty miles apart. A secondary triangulation is then carried out to cover the areas between the primary points, and then lastly a tertiary triangulation "breaks down" the secondary. The distance between one tertiary point and another is usually two or three miles and their accuracy is approximately equivalent to that aimed at in the points fixed by the survey company personnel as bearing pickets, i.e. correct to the nearest yard (or metre) in position. Once the co-ordinates of these tertiary points are available, the plane-tabler can plot them on his board and begin mapping the detail. The whole proceeding must be under a centralised control, and it will be noted that the plane-tabler can do nothing except reconnoitre his area until the results of the various triangulations have been worked out. The brigade surveyors are at present in a position somewhat similar to that of this plane-tabler.

It is the duty of the R.E. surveyors to extend a framework of trig. points of a secondary order of accuracy over the area of active operations, and the R.A. survey companies work from these points and fix others of a tertiary nature, including bearing pickets. Meanwhile the brigade surveyors can reconnoitre the areas that directly concern them; but they are able to do little else. They may not be kept waiting long; but it happens occasionally that difficult country makes extension from the R.E. framework a slow process, and the R.A. survey company may take some time bridging the gap. In such a case why should the brigade surveyors wait? Why should they not start as soon as the brigade halts on their own local grid, with the object of locating on it their batteries, observation posts and targets? If they mark clearly one or two of their fixed points and arrange to have them included in the survey company framework, it will not be difficult to amend later on the arbitrary co-ordinates of such points as may then be required into agreement with the correct ones.

An arbitrary grid is certainly most undesirable whenever it can be avoided; but when lack of survey data makes it necessary, it should cover as large an area as possible. Therefore any one brigade in a division should not initiate its own arbitrary grid

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"origin," but the officers in charge of survey parties would try to arrange between themselves and the O.C. divisional survey sub-section the selection of some mutually convenient point, probably somewhere between observation post and battery areas, as the common origin of their respective survey operations. If each were to start on its own, one brigade's co-ordinates would be unintelligible to the others, and they could not assist each other in target fixing from the longer base of the divisional front.

This procedure would apply mainly to the brigades following close up to the advanced troops, so that distances between observation posts and battery positions would be comparatively short. The divisional survey sub-section would act as at present, but it would be relieved of a considerable amount of detailed work in the forward area, and would have the comfort of knowing that the forward brigades were not waiting for them. Also the reconnaissance of the officer in charge would be simplified, and this means time gained. It is in the matter of the time spent over reconnaissance that decentralisation should help most; anyone who has worked out schemes for divisional survey sub-sections knows how much time is used up in reconnoitring, even when maps are excellent and the ground familiar and easy from a survey point of view. But a brigade survey officer is concerned with an area small in comparison, and as he moves forward he can look around him and study the possibilities of the ground, so that once he halts and has to start work very little more reconnaissance is needed.

The above suggestions affect field and medium brigades rather than heavy batteries. The latter would have to rely on the assistance of the survey company personnel; for their positions would normally be so far from the enemy and their targets so much further away in the enemy lines that the survey framework, from which the guns and targets are fixed, will have to extend over a large area laterally as well as in depth. Observations to fix distant points cannot be confined to one division's front; therefore at this stage it is the officers in charge of the divisional survey sub-sections who have to co-operate in order to get the best results.

If this proposed extension of initiative be allowed to survey officers of brigades belonging to a division, these officers must have a sound general knowledge of survey to enable them to grasp

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quickly the possibilities of each situation; and it would probably be necessary for one of them to be recognised as being responsible for the selection of the common origin and for the general co-ordination of the work. But as long as only one surveyor is allowed for each of their batteries, little advance on these lines can be hoped for. Two or three years ago the number of surveyors on the establishment of a battery was reduced from four to one, and survey became more than ever the realm of the specialist. I do not suggest that as many as four are necessary; one more per battery would doubtless be sufficient. Some might be surrendered by the survey company, for the divisional sub-sections should be able to dispense with at least a few men.

As frequent mention has been made of the "officer in charge" of the brigade surveyors, it seems advisable to point out that the existence of this individual is not yet officially recognised, for no provision is made for him in either peace or war establishments. But surveyors must have a leader and preferably one who is not changed frequently, so it is to be hoped that eventually an additional officer will be allotted to a brigade for this duty. Meanwhile it must be assumed for the purposes of this article that some battery has been persuaded to surrender an officer to take his place. Under the arrangements outlined the officers of the brigades would perhaps feel that preparations for predicted shooting were part of their normal duties, and that once in position there would be nothing to keep them waiting. But co-operation with the divisional sub-sections would remain none the less essential; the brigade surveyors must not start working out results based on their arbitrary origin, if there is any possibility of the survey company producing in time its correct co-ordinates.

III. Suggestions concerning the use of instruments.

The brigade surveyor knows that he must produce some sort of a result in the time available, and he should be able to give an idea of the accuracy with which he has fixed his points; he, unlike the survey company surveyor, is not tied down to any particular standard. When considering the choice of methods and instruments, the size of the area concerned must be taken into account; for obviously a given error in observing a bearing from

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one point to another has an effect on the calculated co-ordinates of the second point which is directly proportional to the distance between the two points. Hence in order to obtain a similar standard of accuracy in co-ordinates, rougher instruments can be used over smaller areas; under different circumstances the director can replace the theodolite, and the range-finder the tape or the subtense method of measuring distances. The importance of this is that, generally speaking, the more simple the instrument the quicker it is to use and the shorter are the subsequent calculations. Thus time is saved.

The fact that the hundred per cent. zone of a gun is much longer than it is wide may also affect a survey plan; it follows that the observation post nearest to the brigade's general line of fire to its target area should be provided with the best instrument and be most carefully fixed. For our aim is to fix the target in such a manner that the bearing gun—target, which has to be calculated from co-ordinates, is obtained as correctly as possible; the accuracy of the range is a secondary consideration. In the example illustrated in Diagram 1, it is important that the north

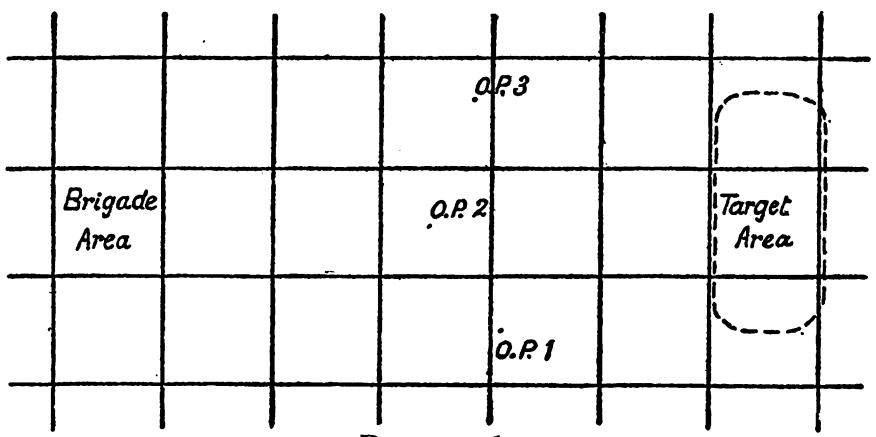

DIAGRAM 1.

co-ordinates of the targets should be accurate, for they, far more than the east ones, affect the gun—target bearings. Therefore if it is essential to economise time, O.P. 2 must be carefully fixed and used; one of the other two can locate the position of the target on the bearing from O.P. 2, while the third (assuming it to be the least accurately surveyed) acts as a check on the two ray intersection provided by the others.

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Again the nature of the object in the enemy lines and the purpose for which its co-ordinates are required affect the means selected to locate it. A small building chosen as a control point needs to be well fixed as regards both east and north co-ordinates; therefore it deserves the most careful observations followed by calculation of the answer. If, however, the object is a target of indefinite shape—such as a clump of trees—on which it is intended to fire a concentration, great accuracy in observing bearings is useless, for the various observers cannot on most occasions pick out a common point to lay on. The plotting on a plane table of the bearings reported from the observation posts will produce sufficiently good results.

Having touched on general conditions which allow surveyors to use rapid and comparatively rough instruments, a few remarks on the detailed use of these instruments may be of interest.

The plane-table can be of great value in many ways in artillery survey, and it seems that far more use might be made of it, and operations correspondingly speeded up, where graphical observation of angles and plotting can be practically combined with, or substituted for, other methods entailing more or less lengthy calculations. It is certainly a somewhat cumbrous instrument, and a number of odds and ends have to be carried about by the plane-tabler; also it suffers from being regarded with a considerable amount of derision owing to its alleged inherent inaccuracy, and because of the fact that it is somewhat conspicuous. The latter reason weighs particularly with those who have seen war at close quarters when they watch it used by those who have not had this experience. A dazzlingly white plane-table on a bright sunny-day, set up on a Salisbury Plain ridge, a few hundred yards from a theoretical enemy, certainly seems far from being a practical proposition. But that is not the fault of the instrument; such feats of daring in the face of an imaginary foe are not confined to surveyors! Admittedly the white table is easily seen; but we hope that in a year or two this drawback will be done away with by the introduction of a pale brown or green paper or celluloid substitute. Then the instrument will be no more visible than a director.

As for the allegation of inaccuracy, the correctness of the results depends on the scale of working, if we assume that the plane-tabler

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is skilled; although the character of the objects observed naturally also affects the answer. The table represents on a scale of 1/10,000 an area of slightly more than five thousand yards by four thousand, and points carefully fixed from accurate trig. points should certainly not be more in error than three to five yards; for co-ordinates can be read by means of the grid to the nearest two yards. Thus the area to be worked over governs the scale which is to be employed, and so it follows that the instrument is of more value to brigade than to survey company surveyors.

As an example of the use of a plane-table on different scales, the following case might be taken. Suppose that a point is to be fixed as a bearing picket and that the result is wanted urgently; from the site selected four trig. points are visible, A, B and C, from two to three thousand yards away, and D, about six thousand. First plot all the trig. points on a scale of 1/20,000 and resect the position; if this works out well, one can assume that the co-ordinates of the trig. points are correct and that they have been plotted satisfactorily. The answer from this fixation may be anything from five to fifteen yards wrong as points cannot be read off the grid more accurately on this scale. But if one now plots the three near trig. points on a larger scale (for example 1/10,000) and repeats the resection, the answer should be correct to two to five yards, assuming the trig. points to be well placed. Thus the position is obtained accurately enough. Bearings, however, which are more important, cannot be measured directly off the table with a protractor; but if the bearing to the most distant trig. point be calculated from the second co-ordinates of the picket and those given for the trig. point, it should not be more than three or four minutes wrong. Rounds of angles are taken with a director to suitable reference objects, and the readings to them converted to bearings by means of the calculated bearing; a bearing picket is then ready, accurate enough for immediate needs. It can of course be improved later on should there be time to spare.

If no director is available, the plane-tabler can, unaided, prepare quite a good bearing picket card. The ordinary protractor is useless for measuring bearings for such purposes, for it can only with difficulty be read to the nearest half-degree. But if the plane-tabler, when set up the second time (i.e. on the larger scale), draws

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rays to all the points to be included in the bearing picket card as reference objects, and extends these rays to the edges of the board, he can calculate their bearings, using the co-ordinates of his position and the co-ordinates of the point where each ray cuts the outside grid line. Under good conditions these bearings need not be more than five minutes in error.

A plane-tabler can also be employed in place of a director in triangulation over a small area. To illustrate this take the case of a brigade survey officer who finds that two trig. points—about two thousand yards apart—are accessible, and wishes to fix from them by triangulation a couple of other points. Time is very limited and there is a shortage of personnel; therefore he cannot afford to send out several pairs of observers and then spend a valuable hour or two in calculating afterwards. But if he has a good plane-tabler, and can provide him with transport, almost as good results can be obtained far quicker.

In Diagram 2, A and B represent the two trig. points; C and D are two points to be fixed as bearing pickets; all four are intervisible. The plane-tabler plots A and B on a scale of 1/5,000, goes

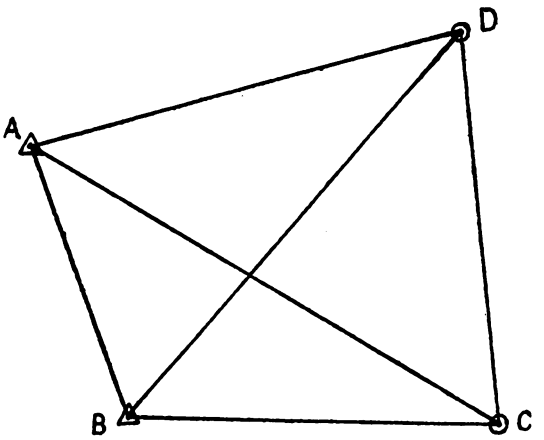

DIAGRAM 2.

to A, sets his board by laying on B, and draws rays (continued to the edge of the board) to C and D. He then repeats the process at B and so obtains two-ray intersections for C and D. He then moves to C, orients by A, and checks the setting by means of B. He has thus observed the three angles of the triangle ABC. While at C he draws a ray to D, which should pass through the point

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of intersection of the two rays already drawn to D. Finally he can set up at D and make doubly sure that the four points on his table correspond exactly with their positions on the ground. Provided that the plane-tabler is a neat worker, and that the trig. points are well fixed and correctly plotted on a carefully gridded board, the measured co-ordinates of the two bearing pickets should be within two yards of the truth—and no calculations are needed.

Perhaps the above examples will assist in dispelling the belief that the plane-table is necessarily an inaccurate instrument. A plane-tabler should be included in the programme for every small-area survey operation; if he cannot function independently, he can, by plotting all the results as soon as they are available, always provide a valuable check against any large errors, and the co-ordinates he produces from the plotted bearings to targets, etc., can be adopted in urgent circumstances as the accepted ones for the required points or, if time allows of calculations, as trial points. Lastly, it may not always be remembered that the fact that the grid lines on a plane table are at right angles means that it provides a simple and rapid method of laying out a sub-base.

If a surveyor has worked on accurate lines he can readily grasp the extent to which rougher methods can be made to suit a particular purpose. In the limited time available in a course of instruction, the object aimed at is to teach the student first to be comparatively accurate, and then, if there are days to spare, to give him practice in applying the same principles under conditions in which rougher results will suffice. Therefore because the prismatic compass and the range-finder rarely feature in survey exercises given on courses, it does not mean that a surveyor should not make use of them. He certainly should do so, providing he understands their limits of accuracy and realises when it is safe to employ them. In close proximity to the enemy they may be most valuable, as they provide inconspicuous means of measuring bearings and distances. The compass gives better results if it is employed somewhat similarly to a director and not used to give bearings from magnetic north. For example, if a grid bearing from A (a fixed point) to B is wanted, the compass reading to B is noted and then the reading to another fixed point C. Thus the difference between the two readings provides an angle by means of which the required bearing AB can be

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deduced from the known bearing AC. This result has been obtained independently of the magnetic variation of the compass.

As for the range-finder, its probable error ($4R^2$, where R equals the number of thousands of yards in the range) must be born in mind; the more accurately an answer is required, the smaller must be the distance it is used to measure. When a better range-finder is evolved, survey will be greatly simplified. The director is gradually taking over a great deal of the work which it used to be thought could only be done satisfactorily with a theodolite. In fact it seems that brigade surveyors never need a theodolite unless they are called upon to perform work that is normally included in the duties of the survey company personnel. The existing types of theodolite take a long time to use in any but expert hands, and their widespread issue has tended to give brigade survey an unnecessarily difficult and complicated atmosphere.

The possibilities of various simple instruments having been discussed, an illustration of their use in combination seems called for.

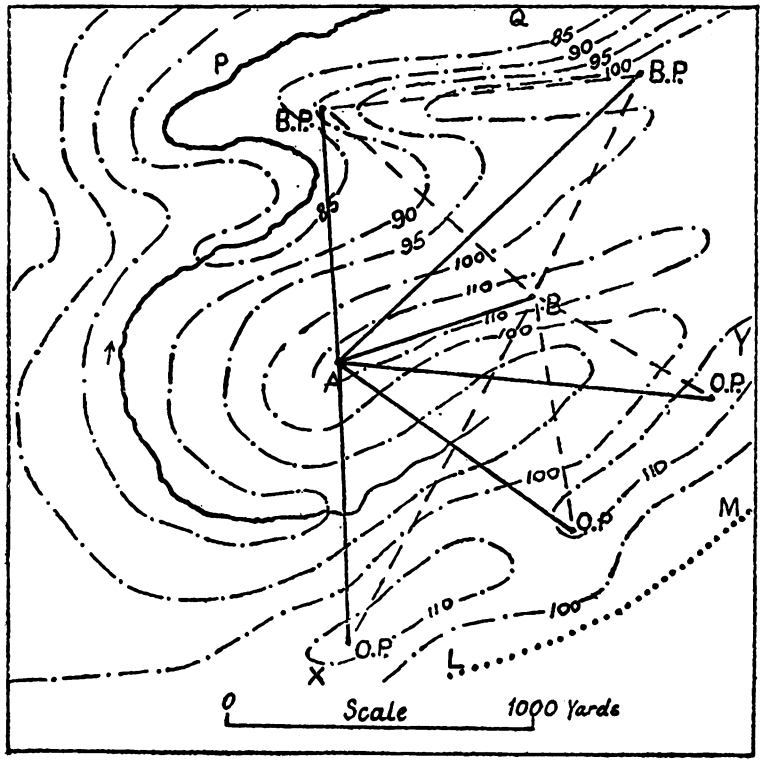

DIAGRAM 3.

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Referring to Diagram 3, LM represents the line of contact between the opposing forces. A brigade is ordered to come into action in the valley PQ, and to be ready to open fire in three hours time in support of a surprise attack. Its presence is not to be disclosed beforehand if it can be avoided. The brigade is now at Q. Reconnaissance shows that observation posts must be on the ridge XY, and that this ridge is hidden from the one immediately in front of the battery position area by the high ground about AB. No co-ordinates of points have been received, and only a small scale map of doubtful accuracy is available. Obtaining the line by T.O.B. is not possible; measuring off the map would result in an error of many degrees, for there are few landmarks that can be used in recognising one's position. The survey officer is therefore asked to help.

He finds that a good all-round view can be obtained from the point A; he arranges for three observation posts, visible from A, to be selected (and also marked, if no existing tree or other feature can be used to lay on), and has banderoles erected at two points which will be useful as bearing pickets to battery personnel. A director, a range-finder and a plane-table are taken to A; another point B, from which A, the observation posts and the bearing pickets can be seen, is found a few hundred yards away from A, and the distance AB is measured by taping or by the subtense method. The bearing AB is obtained as accurately as can be done with the director compass, and by means of the known magnetic deviation this can be converted into a true bearing; it is then accepted as the local or arbitrary grid bearing for AB. The plane-table is set up at A, oriented on B, and rays are drawn to all observation posts and bearing pickets. All the distances are at the same time measured with the range-finder, and if this is done several times the mean results should not be more than four or five yards wrong over the greatest distances.

By marking off these distances along the corresponding rays on the plane-table on the scale of 1/10,000 a position for each point is obtained; but before co-ordinates are read off the grid, the plane-table is moved to B and there oriented by A. Rays are again drawn to all the points to be fixed, and if they pass through or very near the already marked positions, these can be accepted as correct.

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The co-ordinates for the origin A will be taken as accurately as can be judged from the small scale map, if it is gridded; if not, a purely arbitrary value is adopted. The co-ordinates of all points can now be read off the plane-table. Meanwhile a director is set up at A and rounds of angles taken to all points, including B. Then the resulting mean readings to observation posts and pickets can be converted to grid bearings. These bearings are signalled to B.P.1 and B.P.2, and they will enable bearing picket cards to be made out from already observed rounds of angles to reference objects. The correctness of the bearings on the cards can be tested by including in the rounds the other picket (or, if they are not intervisible, the point B) and comparing the bearings deduced from observations with those obtained by calculation from co-ordinates.

If the operation has been carefully carried out, it is quite reasonable to suppose that the bearing pickets are correct to four to five minutes in arbitrary bearing and five to ten yards in position on the arbitrary grid, and no greater accuracy is really necessary. With regard to the observation posts, should it be possible to take directors to them, these instruments can be oriented so as to read grid bearings if the reverse bearings to A are put on the scale and the telescopes laid on that point. Readings to targets are then reported to the plane-tabler who plots the corresponding rays on his board, and reads off it the co-ordinates of the objects required. If the bareness of the ridge XY or the activity of the enemy prevent the setting up of directors, the angle at each post between the target and A can be obtained with a prismatic compass. This angle will be similarly plotted by the plane-tabler.

Methods such as the above may be necessary even if a gridded and really accurate 1/20,000 scale map is available; for if the ground is very bare of features it may be impossible to read off the map either one's own position or that of the enemy to within a reasonable degree of exactness. In any case the original bearing should not be measured directly off the map; it can be calculated from the co-ordinates of one point occupied and those of two (in order to provide a check) distant visible trig. points, or, if one's position is not fixed, obtained by observing the angle between a star and a ground R.O. at a given moment, while another observer, at a known point, measures the grid bearing to that particular star at

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the pre-arranged instant. Then the latter circulates this information to all units interested.

Each situation, however, will differ from every other one, and it is only by practising a number of survey schemes that one can appreciate the easiest solution that will fit in with a particular case. Predicted shooting need not imply—as so many think—fearsome calculations and elaborate observations with a theodolite; so it is hoped that this article has helped to point out how a knowledge of survey enables one to obtain a good value for line and range, even when little time is available and no survey company personnel are there to assist.

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FORWARD OBSERVATION.

By Major R. S. Ellis, o.b.e., m.c., R.A.

THE title of this article is a term generally understood to mean supplementary observation which can be obtained in a rather more forward area than the main battery observation post. As such, it is understood by the writer. The questions involved are dealt with here from the gunnery point of view only and all tactical considerations are omitted. Gunnery itself as a science or, as some term it, an art, presents many difficulties in its application, but these, in ordinary normal circumstances, can be overcome to a large extent. Experience, practice and the guidance of certain principles lead us to adopt methods which give satisfactory results. Also text books and teaching can and do lay down rules which can be followed by even the most inexperienced of us and success is generally within our grasp. But, apart from ordinary normal gunnery, and lying, so to speak, on the fringe of it are many problems and situations which can be solved or met by following no hard and fast rules and for which it would be impossible to provide any; though, if failure to achieve our object is to be avoided, certain guiding principles and considerations should be kept in mind.

The question of how best to produce fire in the quickest time and with the best effect when observations have to be translated into fire orders through the medium of precarious communications, with a relay station may be classed as one of the most difficult problems of to-day. Let us first of all consider the employment of forward observation in general. What does it mean? Leaving aside static warfare as we knew it during the greater part of the last war in France, why does the necessity for forward observing officers arise? The answer to a large extent rests on tactical considerations, which are outside the scope of this article. But, to a battery commander doing his best to make the utmost use of his fire power in the area or zone allotted to him, the following reasons must appeal:—

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(a) The first O.P. (and probably the best for the moment) to be established is one giving a good general view of the ground and is therefore likely to be rather behind the front line with easy, or reasonably easy, communications to the battery. Obviously, therefore, a second, though more restricted, form of observation is helpful, or even necessary, in order to keep in touch with areas over which no observation might otherwise be possible.

(b) In mobile warfare, which to the gunner is the form of fighting which produces his greatest difficulties, the necessity for close touch with the infantry commander (or other commanders) may often force the B.C. to an O.P. the choice of which is subservient to the urgent needs of such personal touch. A forward observing officer, able to ask for and obtain gun fire assistance for forward bodies of constantly moving troops, becomes almost a "sine qua non."

(c) Communications, the nerve links of a battery, without which nothing can function, call for the siting of the main O.P. at such a place that the establishment and maintenance of lines are reasonably secure. A forward O.P. is badly wanted to supplement the work at the main O.P., though owing to its precarious communications it cannot be relied upon entirely.

(d) A forward O.P. gives the B.C. that comfortable feeling that he has a definite clue and often very definite information as to his future location in the event of a forward move; quite apart from the "intelligence" provided.

(e) Sundry other reasons suggest themselves, e.g.: assistance in observation to the main O.P., early information of movement, etc.

Sufficient has probably been said for us to see clearly that the employment of forward observing officers is almost a matter of normal procedure. A few words as to how these considerations are affected by present and possible future developments in materiel may not be out of place here.

Long range guns.

This development does not appear to alter present ideas materially. Greater range will often imply fewer and longer changes of a battery position and consequently the need of a for-

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ward O.P., to which the duties of the main O.P. can be transferred as the fight progresses, becomes, if anything, greater.

Tanks.

From the B.C's point of view early information is of the utmost importance. Even the negative assistance afforded by the knowledge of a broken and helpless forward O.P. may be very valuable in rapidly changing situations where quickness of decision is of the highest importance.

Wireless.

It is in this development of the means of communication that the greatest effect on the employment of forward observing officers will be felt. The close support of infantry and other arms in the field depends on the speedy response of a battery to a call for fire. Such speedy response is difficult to ensure with the means of communication at present available unless the guns themselves are so placed that adequate and sure communication can be relied upon. Hence the almost universal opinion that artillery in order to afford close support must be itself in action not far from the infantry who require the assistance. There are undoubtedly many pros and cons which can hardly be discussed in a few words but the main principle of speedy response stands out and communication is the main difficulty.

"Wireless" opens up a completely fresh outlook on this problem and puts into the hands both of B.C's and their F.O.O's the power to give this speedy response wherever the battery itself may be located (within limits). This however is only a part of the effect wireless communication may produce. Its ultimate effect may be far reaching. It is not, however, the intention of the writer to enlarge a great deal here on the subject of wireless communication. It will be touched upon a little more fully later in this article. It is with the present available means of communication that most of our difficulties are concerned and it is with to-day we have to deal whatever to-morrow may bring forth.

Considerations.

The above arguments, together with others which can doubtless be produced are a sufficient apology for a discussion on the two

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main questions of forward observation. These are in brief:—

A. The importance of providing forward observation.

B. The difficulties of making the greatest use of it.

Our text books and regulations deal to a limited extent with both these aspects but much is left to the judgment and initiative of battery commanders.

It may be considered that different forms of fighting affect the problem and that it should be dealt with under different heads. Firstly, during a fight of a moving nature when the situation is changing more or less rapidly from hour to hour or day to day; secondly, during a static phase of warfare; and thirdly, in situations of a definitely defensive nature. But the actual gunnery problems involved do not alter in character and the difficulties only vary in intensity. The need for forward observation is still present.

Training.

Warfare is the only true test of any method or system, and we must train on lines such as will lead us instinctively to adopt such method when the test comes. Let us consider how our training in this respect helps us. Training in peace time as far as gunners are concerned is carried out in two distinct phases—practice camp with live ammunition, and manœuvres with other arms on a large or small scale. It is the writer's contention that during the course of both these phases of training we are very apt to lose sight of the two main questions A. and B. which are mentioned above. The unreality of situations, which cannot be avoided altogether, tends towards this. But much can be done. It is proposed to return to this later.

Organisation.

Again, are we organised to admit of our carrying out our desires? Theoretically, of course, we are. But we should remember that what we see in theory will not always be borne out in fact. To take one aspect. Is it not within the bounds of probability that, on mobilisation, the subaltern officers of a battery will, at any rate temporarily, be reduced in numbers to two, in order to supply the essential needs of a second line army? If we agree with the importance of our question A. above, then officers as section

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commanders will disappear. As regards question B.; will not our carefully trained and nurtured band of specialised signallers be reduced for similar or other reasons to a greater or less degree? Unless we are ready to meet these possible contingencies and train ourselves to that end, something will suffer.

Practical details.

It is not claimed that any of the following ideas are in any way brain waves, but they are merely an endeavour to present in a simple form the ideas which should run through any responsible officer's mind when the situation demands, as it usually will, the employment of a second or forward O.P.

The decision as to the necessity of forward observation.

This decision rests with the battery commander. It is to his advantage or otherwise. What should this decision rest upon? Primarily it may be said to depend on the time factor. If time is available (and it is almost impossible to consider a situation in war when batteries will change their position so quickly that it is not worth while making the extra "bundobust") then a forward O.P. should be established. Our training at practice camp does not always bring this out. Sometimes the necessary precautions for safety stand in the way; but not by any means always. Also situations change and batteries move with an artificial rapidity, and battery commanders are apt to lose sight of the value of forward observation for this reason. Again, perhaps a relic of old ideas, battery commanders are inclined to limit their actions to what they consider is actually required of them to hit a special target and wait until some member of the staff states that the next series will be one for a F.O.O. In addition, part of the value of second observation is never realised, i.e. the assistance which a second observer can give where targets are difficult or observation from the main O.P. for some reason is not easy.

It may be said that manœuvres and field operations give ample scope for initiative in this respect. In a sense this is true. But the technical difficulties such as choice of O.P., signalling, etc., are never brought out unless live shell are fired, observation has to be obtained and fire corrected. Too often results are taken for

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granted. Should we not, therefore, give much more freedom to B.C's at practice camp to study a situation and give them the opportunity to take the action which should be natural to them in war? It is not irrelevant to mention at this point that a forward O.P. may often be rather of the nature of a flank O.P. though generally it will perform its functions better in an advanced position. Flank observation required for a definite object will often be additional to the forward O.P. but this can generally be satisfactorily carried out by one or perhaps two members of the B.C's staff who are temporarily detached and not intended to form a permanent O.P.

Composition of a forward observation party.

This will often present difficulties, particularly with a shortage of officers. It is essentially an officer's job. A capable signaller is, of course, necessary. Whether two signallers can be sent is very uncertain. Very often they will not be necessary. To a large extent it depends upon the situation. Two men in addition to the officer allow for one casualty or one can be used as a runner, but he should have a knowledge of signalling. The party cannot be less than three; it might in some circumstances be increased. To those who agree so far with what has been said, this fact means the permanent allocation of one officer and two men who are ready and prepared for the job. We can hardly get away from the fact that this means an extra drain on the battery personnel. We cannot in war call on the reserve group of signallers which should be kept complete as a unit. As regards the officer, it seems likely that the battery leader, after the completion of his work as such, will become the F.O.O. The G.P.O. is an important functionary. His work is a whole time job, especially if no other officers remain in the battery position.

The equipment taken by a forward observation party should, and must of necessity, be limited. There is little available. A compass, a map, a signalling lamp and a pair of small flags are essential. Telephonic communication will probably come later but will usually not be attempted at first. This must depend on the situation. At this point at once we think of "wireless." If satisfactory working can be ensured and really portable sets are in being, the F.O.O. problem assumes a totally different aspect.

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Responsibilities delegated to F.O.O.

No officer should be sent forward as F.O.O. without a very clear idea, not only of the situation as it stands from the gunnery point of view but also of what his battery commander expects him to do and how he is to do it. (The question of where he is to go, the location of troops, etc., are not considered here). The gunnery situation includes all information likely to be required under any circumstances—location of battery, direction of zero line, etc., and the position of reference points. These reference points must be chosen with care, agreed upon between B.C. and F.O.O. and if possible be points which can be located on a map. Not many are required, a lot tend to confusion. General instructions should be given, particularly as to the methods the F.O.O. is to use. We must remember he will usually have only a restricted view, he will be out of personal touch with his commander and he may be influenced by purely local happenings. He cannot be continually sending a call for fire or it may be regarded as a cry of "wolf"; also ammunition is limited. Very often definite instructions can be given; sometimes not. But there is one thing which seems to stand out clearly—fleeting opportunity targets will more often than not fall to the lot of F.O.O's. These are the ones that matter most and it should be very clearly understood between F.O.O. and B.C. how these should be engaged. It is hardly too much to say that a very large percentage of the value of forward observation depends upon ability to take full advantage of fleeting opportunities. Other targets there will be, of course; targets of a deliberate nature hidden from the main O.P. and targets which require double observation if possible; but the successful engagement of these is not so dependent on the time factor.

If we accept as an axiom that what is commonly known as a "series" can be successfully conducted by one man only at a time, we come to the important point. Is a F.O.O. to be regarded as an observer only? or should he conduct the series? To mix the two distinct methods or to endeavour to engage a target by partially one and partially the other method, when only signalling communication is available, leads to confusion and consequent delay. Such confusion would be most marked even if the F.O.O. and B.C. were within speaking distance of one another, but when

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the complication of a signalling link is added the result is almost inevitable failure in cases where speed is the main factor. It should therefore be definitely understood by a F.O.O. how he should carry on. Which method is the best is a difficult question to answer and must depend on the situation. Factors such as the location of the F.O.O. and the quality of the communications will probably make the decision easy. But if we consider a normal situation of a F.O.O.—a thousand yards or more in front of the main O.P., perhaps lodged insecurely behind a rock with a signalling lamp—communication just obtained and a priceless target offering itself—then in the vast majority of cases the best result will be obtained if the F.O.O. acts as an observer only and the B.C. conducts the series.

It is not difficult to imagine another situation—a securely established forward post—telephone communication, possibly laid through to the battery itself—a deliberate target hidden by accidents of the ground from the main O.P.—then better results will follow by eliminating the inherent vagueness of clock code observation methods. The main point the writer wishes to make is that, having engaged a target by acting as observer only, a F.O.O. must realise that the conduct of the series is in the hands of the B.C. and he will only cause confusion and delay if he changes his method in the middle and tries to send executive fire orders. This is discussed again later in considering communications. But we must have elasticity, and this is not difficult to obtain. It is not necessary to change command.

Communications.

It is on this question that the choice of methods hangs, and it is in connection with this that most of the difficulties arise. Let us consider first what are the main features of ideal communication. They may be summarised as follows :—

(1) Quickness of establishment.
(2) Ease of maintenance.
(3) The requirement of as few personnel as possible to work them.
(4) Capability of easy two-way working—simultaneously or practically so.
(5) No need for intervisibility of stations.

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If we now take the means of communication at present available, i.e., telephone, lamp or flags, we find that each individually fails in one way or another to reach the ideal, but that they stand in the order of merit as given above for general purposes. Telephony then is the best at present (by which, of course, is meant line telephony). Its low standard in the two essentials—(1) and (2) above—makes it, however, unsuitable for F.O.O. work, at any rate in the first instance, and we have to fall back on lamp or flag communication, which fail in the requirements (3), (4) and (5) mentioned above.

Firstly comes the difficulty of a relay station. It is seldom that a F.O.O. can communicate directly with his battery until the more deliberate stage has been reached and the main O.P. in all probability is the relay station. Secondly, two-way working implies that the relay station will generally expose itself in the forward and enemy direction—a very serious disadvantage. At present we have to face these difficulties and all we can do is to minimise them as much as possible. Speed and simplicity are what we want to aim at; we want the orders to reach the guns with as little delay and as few sources of confusion as possible. It has long been realised that the sending of artillery executive orders in "clear" by means of lamp or flag signalling is long and tedious; too slow altogether for such work as we are considering. Some form of code and abbreviation being absolutely necessary.

For speed, therefore, we may employ code. But if code is employed it is necessary to check it back from the receiving station and to encode and decode the message. We can perhaps dispense with checking and rely on sending the messages twice, but with the artillery code this is not altogether satisfactory. With a system of abbreviations there is, perhaps, less liability to error. At any rate the method, although quicker than when orders are sent in "clear," still cannot be considered quick enough to deal with fleeting opportunities especially when a relay station is interposed between F.O.O. and battery.

If, however, only observations, as distinct from fire orders, are required from the F.O.O., then a modified form of message as used with air observation can be employed. From the signalling point of view this is quicker. Encoding and decoding is not

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required and reliance can be placed on duplicate messages without checking back. Whether the observations are translated into orders at the main O.P or at the battery is not important; it depends largely on the situation at the main O.P. But clock code messages are simplest and, as we can see, the quickest. We can therefore now turn our attention to

Methods to be employed.

Let us consider three normal situations.

(a) A F.O.O., with limited personnel, in a mobile situation with lamp communication.

(b) A F.O.O. temporarily stationary, with a single telephone line to main O.P.

(c) A F.O.O. firmly established in reasonably good telephone communication with main O.P. and battery.

We can take each in turn. Firstly in (a), we shall do best with observations only. Many factors combine to make this the quickest and most simple method. As we are considering fleeting opportunities chiefly, clock code observation is probably sufficiently accurate and messages as used in air observation procedure can be used to indicate to the B.C. the method he should employ. The target may be stationary; in which case no difficulty arises. A moving target is more difficult. But as we should, in the writer's opinion, rule out any form of fire command from the F.O.O., then we must adopt a procedure similar to that used in air observation. It must be quite clear between F.O.O. and B.C. how this is being carried out. Simple letters, e.g., "F.G.", "G.O.", can be used to indicate the nature of fire considered necessary by F.O.O. and there seems to be no reason why existing code letters such as "M.Q." and "K.T." should not be employed in cases where a target is moving and the F.O.O. is uncertain as to the time interval he should allow for in his prediction of the target position. This is more important probably with medium artillery equipment. With field artillery the time interval can be judged more easily or a recognised time interval could be adopted. The conduct of the series, the decision as to the method of ranging and the type and amount of ammunition to be employed, is with the B.C. This has the great advantage that difficult two-way working can be dispensed with and it seems to be the only practical method. Indica-

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tion of target position by F.O.O. may be by clock code from a reference point or by co-ordinates. It is immaterial which.

Secondly in situation (b). The B.C., being in communication with F.O.O., can use either method depending on the likelihood of maintenance of communication and the ease with which the F.O.O. can conduct the fire, i.e., his knowledge of line of fire, ranges, etc. The B.C. can ask for observations only or he may hand over the conduct of the series to the F.O.O., or he may conceivably complete his ranging by clock code observation and then hand over command to the F.O.O. So long as telephone voice communication is maintained, no confusion should arise.

Thirdly, as regards (c). In this case the forward O.P. can be regarded as a second O.P. from which targets can be engaged by the normal conduct of fire as and when desired by the B.C. It would be the exception to use it for giving observations only.

Note.

It is also obvious from the above that, in the cases where clock code observation is advocated, it is more than likely that the F.O.O. is not conversant with the lie of the land, and that he is not in the line BT. The conduct of a "series" is consequently rather difficult and, for this reason also, observations only will lead to a quicker result.

Brigade Aspect.

A great deal of thought is being devoted at the present time to the possibility of some concentrated form of F.O.O. control of the fire of a brigade of four batteries. In situations where the course of fighting has carried the forward troops beyond the immediately visible and known zone of fire, concentrations of fire to cover further infantry advance may be called for on certain points and the time available may be limited. One F.O.O. only may be available. Predicted fire, combined in some cases with the ranging of perhaps one or two guns, is probably the best way of carrying out such concentrations. The communications, as we know them now, are the great difficulty, and the solution of this problem will put into the hands of a commander a very valuable means of clearing a way for the infantry at the moment when advanced troops are badly in need of assistance.

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Ammunition.

There is little to say on this subject. But in the cases where the F.O.O. indicates target position by clock code reference or by co-ordinates, it is clear that calculation of angle of sight is bound to be approximate only. For this reason it would be the exception to use time shrapnel. This applies to all types of gunnery in similar conditions and need not be over-emphasised here.

Conclusions.

If the statements that have been made are reasonable then the following main points are worth summarising:—

More use should be made of forward observation at the discretion of the battery commander.

A forward observation party should always be ready and should have definite instructions.

Methods and use of the party depend upon communications and situation.

Simplicity of method is the keynote and a system should be adopted which minimises delay and avoids confusion.

In conclusion, this article would not be complete without a few words on the effect that wireless communication may have on the conduct of forward observation. (It is assumed, of course, that technical difficulties have been overcome and that portable sets are in being.)

Firstly, it seems likely that the relationship between F.O.O. and main O.P. will change to a large extent. The B.C. with mobile and quick communication at his disposal will not feel compelled to tie himself to a fixed O.P. and, in a large number of cases, will be able to carry out himself the work at present delegated to F.O.O. Thus it may be that the main O.P. now becomes mobile with a secondary fixed O.P. as a precautionary measure only.

Secondly, even if circumstances compel us to adhere to present ideas of a main O.P. for the battery commander supplemented by a F.O.O. with wireless, then the F.O.O. will become more mobile, and, with communication direct through to the battery, a relay station becomes unnecessary.

Thirdly, the possibility of brigade control or co-ordination becomes something much more definite than it is with our present communications.

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One, or perhaps two, F.O.O. parties working with a brigade station in reliable communication with batteries, will be able to observe, or even control, the fire of individual batteries as necessary—either as may be required for any special task or with a view to concentrations of batteries under the direct tactical control of the brigade commander. Those who consider that effective support in mobile fighting will be given best by brigade fire of this description will find in wireless an attempt at a solution of the problem which is at present an extremely difficult one owing to the unreliable means of communication available. Such control of fire comes far more into the picture now that survey work has reached a definite standard and brigade co-ordination is a very real possibility.

The technical difficulties of wireless are not yet all overcome, but great strides are being made and there seems no doubt that this form of communication for artillery work is beginning to come into the sphere of practical politics.

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THE BATTLE OF CAMBRAI.

November 20th to 30th, 1917.

By Major-General H. D. De Pree, C.B., C.M.G., D.S.O., *p.s.c.*

DURING the past winter a number of very interesting lectures have been given at the Royal United Service, Royal Artillery and Royal Engineer Institutions, and numerous articles have appeared in the service journals on the mechanisation of the army; while the thoughts of officers of all ranks and all branches of the service have been directed towards this subject to an increasing extent. It may not be out of place, therefore, to give a description of the Battle of Cambrai, the first battle in which tanks were used under the most favourable circumstances and in adequate numbers. My excuse for doing so is that an ounce of practical experience when bullets and shells are flying about is worth a very great amount of theory and imagination as a foundation for the consideration of a big problem like mechanisation.

The battle of Cambrai is also interesting on account of its violent changes of fortune, and because the British offensive was brought to a standstill not in the trench system of the Hindenburg Line, but in the open country beyond.

In considering the bearing of the lessons of these operations on future war it is necessary to remember that the Mark IV tank was a much slower and less reliable weapon than its successors are; but on the other hand the use of tanks came as a surprise to the enemy, and anti-tank weapons were much less developed than they are likely to be in future wars. The lessons of this battle show that the introduction of new weapons and new methods has not changed the old principles of war, and that surprise, co-operation of all arms, sufficient reserves and rapidity of movement have as great a value as ever.

Preparation for the Battle.

The battle was fought by the British Third Army under General the Hon. Sir Julian Byng, which on this part of its front was opposed

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by the *German Second Army*[1] under General von der Marwitz, the flank of which rested some few miles to the north at Bullecourt. The general idea of the whole operation was given out by the Army Commander to those concerned at a conference on 26th October. The corps destined to carry out the attack were, on the right III Corps (Lt.-Genl. Sir W. Pulteney), and on the left IV Corps (Lt.-Genl. Sir C. Woollcombe). The front held by these corps was roughly, III Corps from Gonnelieu to opposite Ribecourt, and IV Corps from that place to the Hirondelle Valley west of Queant.[2] The Army Commander explained that it was intended to overwhelm the German trench system by a surprise attack of infantry and tanks and to exploit the success afterwards in the open country with the assistance of the Cavalry Corps. The essence of the operation was therefore secrecy in preparation, and speed in execution.

Concentration of the troops in the area.

As regards secrecy of preparations conditions were generally favourable. Autumn was far advanced, and the nights were long, whilst the weather though fine was misty, which made hostile aeroplane observation difficult. The country also was favourable, as behind the British front there were numerous ruined villages and several large woods, notably Havrincourt Wood, which could be used to hide the great mass of artillery and tanks which were to be brought into the area for the operation. The preparation of the area was also greatly facilitated by the fact that a scheme for an offensive had already been put in hand in the spring, and the preparations were already far advanced in many departments. An excellent system of light railways, fair assembly trenches and sufficient Infantry Brigade H.Q. were already in existence. The main preparations therefore consisted in :—

(a) Preparing well-concealed gun positions with dumps of ammunition beside them.

(b) Making weather-proof concealed accommodation for extra troops.

(c) Laying down an open system of artillery and other wires.

[1] NOTE. German units will be shown throughout in italics.

[2] „ No accents will appear on French words.

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(d) Forming dumps of ammunition, road and R.E. material and supplies.

(e) Improving the roads as far forward as our front line trenches.

In addition to the infantry and cavalry to be brought into the area, the strength of the two corps was to be increased from 339 guns to 1009. Hiding places for something like 360 fighting tanks and 63 supply and wireless tanks had also to be found.

It can be imagined that the concentration of such a large force immediately behind the line could not be carried out without causing some moments of anxiety to the corps staffs concerned. The track vehicles of that time, especially the caterpillars which drew the heavy guns, made such a frightful din, that it seemed impossible that they could be got into position without discovery. The noise was drowned to some extent by sending low-flying aeroplanes over the enemy, but the enemy did actually hear the caterpillars without taking much notice. A couple of nights before the attack a train carrying tanks ran into a motor lorry at a road crossing just behind Havrincourt Wood, and was derailed. It could not be moved and it seemed a certainty that it would be discovered in the morning by aeroplanes, but the tanks were able to disembark themselves into the fields and all was well. Finally the enemy raided the IV Corps front on Z – 1 night and took some prisoners. Fortunately the troops originally holding the front trench had been kept in till the last night,[1] and though the enemy managed to extract from these men that an attack was contemplated, they had never seen or heard of any tanks. Consequently, though the enemy learnt that an attack was coming they thought it was to be one of the old-fashioned kind with prolonged artillery wire-cutting and registration, and little harm resulted.

The troops thoroughly entered into the spirit of the thing, and by their care and discipline did their best to make it a surprise.

Training of the troops with tanks.

The infantry of the divisions which were to take part were given 10 days' training with tanks beforehand, chiefly at the tank training ground at Wailly. They benefitted greatly from this and

[1] IV Corps Order No. 319 and report on the operations.

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developed the greatest confidence in the tanks.[1] It may safely be said that never have divisions entered a battle with a higher moral or more confident spirit.

Concentration of the troops in the area.

The day of the attack, "Z," was fixed by the Third Army for November 20th. Generally speaking the artillery were got into position before the infantry, who took over their fronts on the 17th and 18th. The actual guns did not move in till the night of the 17th, but lines of fire were laid out and everything got ready beforehand. The tanks were got into their positions just behind the front on the nights of the 16th, 17th and 18th.

THE PLAN.

Description of the country.

The British front line ran north-west along the forward slopes of the gently sloping ridge on which stand the villages of Gonnelieu, Beaucamp and Trescault, and the large Havrincourt Wood. The trenches of the front system of the German Hindenburg Line lay parallel to our line at a distance of three or four hundred yards, and lower down the same slopes. Opposite to our ridge and some two to five thousand yards away across the Grand Ravine was another gentle down running roughly east and west on which stood the villages of Flesquieres, Havrincourt and Hermies, with the trenches of the Hindenburg Support Line and also further west those of the Hindenburg Front Line, which here turned north, running over it. North of the Flesquieres ridge the country sloped gently into a wide open cup bounded on the west by a spur of that ridge, on the north six thousand yards away by the heights on which stood Bourlon Wood, and on the east by the heights at and north of Rumilly on the east side of the Canal de l'Escaut. In this cup lay the villages of Graincourt, Anneux, Fontaine and Cantaing, and later the gun positions of the Divisional Artilleries of the IV Corps. The ridges rise something like 120 feet above the bottom of the valleys. At right angles to the above ridges, running roughly north and south were the Canal de l'Escaut and the Canal du Nord. These formed as it were boundaries to the battlefield, and were a

[1] 62nd and 51st Division Reports.

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great obstacle to free communication. The Canal du Nord, which was unfinished and dry, ran through a very deep cutting in the Flesquieres ridge, and there were no bridges over it right up to the big Bapaume—Cambrai road. Consequently the only good road leading into the Graincourt basin was that through Metz en Couture and Trescault. All the villages were connected by country roads which are not shown on the sketch map. The Hindenburg Line was a very formidable affair with deep and broad trenches, each with five thick belts of wire and numerous concreted dug-outs. The Hindenburg Support Line was in a less forward state of completion, but had numerous fire bays and concreted dug-outs and good belts of wire. The Masnieres—Beaurevoir, Cantaing and Marquion Lines behind were in a still less forward state, with trenches marked out only. The various systems are shown conventionally on the sketch map by a single line, but practically in all cases they consisted of two trenches 120 to 200 yards apart with communication trenches and switches.

The General Plan.

As already stated the intention was to break through the German defences, sieze Bourlon Wood to the north, establish a good flank to the east in the direction of Cambrai and exploit the situation locally in the direction of the Sense River which ran east and west some five miles north of Cambrai and then turned south through our lines south-east of Arras. The capture of Cambrai was subsidiary to this operation, and was intended to cover our right flank and puzzle the enemy.

In addition to the Cavalry Corps, a large force of French cavalry and infantry was held ready to the south in order to exploit the success. The C.-in-C. calculated that no large German reinforcements could arrive till 48 hours after the attack, and by that time he would be in a position to judge whether the continuance of the operation was justified or whether the action should be broken off.[1]

We had arrived at a period when it was known that tanks were able to flatten a way through the strongest wire, and that the work of the Survey Companies had made possible the putting down of a barrage without previous registration. It seemed probable

[1] Sir D. Haig's Despatches, 20th Feb. 1918.

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therefore that the surprise for which every commander on the Western Front had been earnestly searching during the last three years was at last within reach. With the object of exploiting these newly developed advantages, the detailed plan was drawn out.

The Detailed Plan.

The formal attack on the German trench system was divided into two stages.[1] The first up to the Blue Line included the Hindenburg front line trenches and the village of Ribecourt. The second up to the Brown Line included the Hindenburg Support Line, Lateau Wood and Flesquieres village.[1]

III Corps.[2]

The attack from the III Corps front was allotted to three divisions. On the right the capture of the Gonnelieu ridge, Banteux spur, Bonavis ridge and Lateau Wood was to be carried out by the 12th Division (Maj.-Genl. A. B. Scott). The 20th Division (Maj.-Genl. W. D. Smith) in the centre was to carry out the attack on La Vacquerie, Welsh Ridge and the Hindenburg Support Line beyond. The 6th Division (Maj.-Genl. T. O. Marden) on the left was to capture Ribecourt and the eastern part of the Flesquieres ridge. The 29th Division (Maj.-Genl. Sir H. de B. de Lisle) was to be held in reserve and pass through the 20th and 6th Divisions, in order to capture the heights south of Rumilly and Bois des Neufs.

Tanks (Mark IV) for the attack were allotted as follows:—

12th Div.—2 Battns. (72 tanks). 20th Div.—Right Bde. (1 Battn. = 36 tanks) Left Bde. (2 Coys. = 24 ,,)	Under O.C. 3rd Bde. Tank Corps (Col. J. Hardress-Lloyd).
6th Div.—2 Battns. (72 tanks).	Under O.C. 2nd Bde. Tank Corps (Col. A. Courage).
29th Div.—12 tanks.	

Total ... 216 tanks.

On the capture of the Brown Line one company of tanks from each of the three divisions was to push forward to seize the bridges on the Canal de l'Escaut from Masnieres to Marcoing inclusive, and one company in addition from 6th Division to seize the Bois

[1] Shown on Sketch map.

[2] III Corps Operation Instruction No. 1.
,, ,, Operation Order No. 224.

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des Neufs. These objectives were to be held till taken over by the 29th Division. At the same time the 12th and 20th Divisions were to form a flank from Lateau Wood to the south-east part of Masnieres. After the capture of its objective by the 29th Division assisted by its 12 tanks, the 5th Cavalry Division was to cross at Masnieres and Marcoing and advance to the east of Cambrai. The 2nd Cavalry Division was to follow and support it, occupying La Belle Etoile on the high ground just north-east of Niergnies.[1]

IV Corps.[2]

The main attack on the IV Corps front was to be carried out by the 51st (Highland) Division (Maj.-Genl. G. M. Harper) on the right, and the 62nd Division (Maj.-Genl. W. P. Braithwaite) on the left. The tanks under the O.C. 1st Brigade, Tank Corps (Col. Baker Carr) were allotted as follows:—

51st Div.—D Battn. and	2 Cos. E Battn.		(60 tanks.)
62nd Div.—G ,,	1 ,,	,, ,,	(48 tanks.)
Total ...	108 tanks.		

One squadron King Edward's Horse and IV Corps cyclists were attached to the 51st Division, and two squadrons King Edward's Horse to the 62nd Division.

The other two divisions of IV Corps,[3] the 36th (Ulster) Division (Maj.-Genl. O. Nugent) and the 56th (Maj.-Genl. F. A. Dudgeon) were to assist in the operation as follows:—One infantry brigade of the 36th Division was to capture the Chalk Spoil Heap west of the Canal du Nord, and having gained an entrance into the Hindenburg Line there, was to work its way up it abreast of the 62nd Division, under a powerful rolling barrage. It was finally to assist the 62nd Division in the capture of the canal bridge on the main Cambrai—Bapaume road. The 56th Division was to connect our front line up with this brigade wherever it came to a halt. In addition both divisions were to make a diversion by heavy bombardment with trench mortars, gas, smoke, and a show of dummy tanks. The remaining two brigades of the 36th Division in the event of the attack being successful were to be moved up to a position west of Flesquieres, ready to assist the further advance.

[1] III Corps Operations—Instructions Nos. 1 and 9.
[2] IV Corps Instructions Operation G.Y. (No. 17/4/2).
[3] IV Corps Order No. 320.

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As soon as the Brown Line was captured it was the intention of the Commander of IV Corps to seize the Bourlon position as quickly as possible. The G.O.C. 51st Division, after the capture of Flesquieres, was to push forward an advanced guard to capture the German guns north of that place and Cantaing. The 62nd Division was to clear up the Hindenburg Support Line up to the Cambrai—Bapaume road, capture Graincourt and push advanced guards to capture Anneux and to assist the cavalry in the capture of Bourlon Wood and village, moving west of the wood.

The 1st Cavalry Division (Maj.-Genl. R. L. Mullens), which was attached to IV Corps, was to pass through along the Trescault—Ribecourt road as soon as it was clear, move east of Bourlon Wood, capture and hold Bourlon village, and then move on to seize the passages over the Canal du Nord between the Sense River and Sains-les Marquions (1 mile north of Inchy).

The object of the operations of IV Corps after the capture of the Brown Line was to enable it to continue its advance north-west and cut off the German troops and guns in the Queant salient.

Action of the Artillery.

The artillery available for the battle was as follows:—

	III Corps.	IV Corps.
13 pr.	48	44
18 pr.	264	216
4·5 in. hows.	66	60
60 pr.	50	36
6 in. hows	72	68
8 in. hows	14	16
9·2 in. hows.	16	12
12 in. hows.	4	6
15 in. hows.	2	1
9·2 in. gun.	1	1
6 in. gun	8	4
	545	464

Total ... 1,009 guns.

Of these approximately 670 guns were brought in for the attack from outside.

Broadly speaking the action of the artillery was to consist in placing barrages on each objective prior to its assault, in forming smoke screens and barrages on the front and flanks of the advance

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of the tanks, in neutralising hostile batteries, and in bombarding O.P's, positions of assembly, headquarters and rest billets.[1]

The IV Corps Artillery had an arrangement for dealing with any hostile guns active within the Brown Line, that is to say anti-tank guns. On any such guns being reported either from the ground or from the air, the whole of the heavy artillery doing bombardment work on the divisional front affected was to be concentrated on these guns.[2]

The IV Corps Artillery also had a very powerful concentration of heavy artillery and trench mortars (9·45″ and 6″) arranged on Havrincourt village and salient which greatly assisted in their capture.

For the advance after the capture of the Brown Line, III Corps allotted to the 29th Division two brigades of its own divisional artillery, and one brigade horse artillery from the Cavalry Corps to follow it up. IV Corps for the same purpose placed 4 brigades of field artillery, one battery of 60 pr. guns and one battery of 6″ hows. under each of the 51st, 62nd and 36th Divisions. The heavy artillery of both Corps under Corps C.R.A's also stood ready to assist.

Flying Corps.

Increased activity by R.F.C. squadrons was ordered. Contact planes to report our advance, and counter-attack planes to watch for hostile counter-attacks were ordered to be in the air continuously.

THE BATTLE.

20TH NOVEMBER.

German troops on the front.

So far as can be ascertained there is very little German literature on this battle at present in England. Fortunately there is a reliable work by General von Moser[3] who commanded the "*Arras Group*" of Divisions on the northern outskirts of the battle on 20th November, and who later took over the Bourlon front and finally commanded the northern attack in the great counter-attack

[1] III Corps Instruction No. 1.
IV Corps Artillery Instruction No. 77.
[2] IV Corps Artillery Instruction No. 80.
[3] "Feldzugs Aufzeichnungen 1914-18" p. 310.

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of November 30th. From this book a quantity of useful information can be obtained. There are also the German Situation maps published at the time by G.H.Q. From these sources it seems probable that the following divisions were holding the line on this date:—

20th Division about Queant.
204th ,, Mœuvres to Havrincourt.
54th ,, Havrincourt—La Vacquerie.
9th ,, La Vacquerie—Honnecourt.

Our intelligence pointed to the fact that a relief was probably in progress, the *20th Landwehr Division* relieving the *54th Division*, and that three extra regiments might possibly be in the neighbourhood. It was subsequently ascertained from prisoners that the *107th Division* had arrived on 18th November at Cambrai from Russia in the ordinary course of events. This division was put into the battle on 21st November and had a serious effect on the course of the operations.[1]

The assembly of troops.[2]

Very careful arrangements had been made to get the tanks onto the starting line in touch with the infantry who were to work with them. Tapes were laid from their lying-up places to their places on this line, and infantry guides accompanied the tanks to them. During the night they were safely got onto a line roughly 1000 yards from the German outposts. The infantry parties formed up either behind them or in our front trench to await their passing, according as divisional commanders considered best.

The formation for the attack was as follows[3]:—Each of the four sections of a company, consisting of three tanks, was formed up with one tank as advance guard tank in front and two main body tanks about 100 yards behind. In rear of each main body tank moved a platoon of infantry at about 100 yards distance. The infantry were to move by rushes in such formation as the situation demanded, and as near to the tanks as they could get

[1] "Histories of 251 German Divisions in the War 1914-18." It is interesting to note that this Division entrained on 13th Nov. in the Kovel Sector, and was in action on the Western Front eight days later, a fact which throws some light on one of the great strategical questions of the war.

[2] Reports of the Tank Brigades.

[3] Reports of the Tank Brigades and Tank H.Q. War Diary, App. I.

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without suffering from the fire directed at the tanks. In rear an equal number of platoons followed in support.

Anxiety was caused at one time during the night by fairly heavy shelling of the IV Corps front. But it died down an hour before zero, and the assembly was carried out punctually without discovery. The men of the Tank Corps had had a tremendously hard time getting their units into position, but they felt that they were at last to get their chance, and they went into battle with the same high spirit of confidence as the infantry. Their commander, Brig.-Genl. Hugh Elles, went into the attack in the right-hand leading tank of H. Battalion on the 6th Division front, carrying the Tank Corps flag. The tanks advanced at zero - 10 minutes, and at zero (6.20 a.m.) the barrages came down and the whole attack moved forward. At this time the weather was fine but cloudy, and it was light enough to see infantry at 200 yards.

Attack of III Corps.[1]

The attack of III Corps up to the Brown Line was completely successful. According to the plan the capture of the Blue Line was to be completed and the advance to the Brown Line commenced two and a half hours after zero. Information was soon received that the attack was well up to time, the 12th Division reporting at 8.30 a.m. that its troops were on the Blue Line. At 9.20 a.m. the 6th Division reported that its troops were in Ribecourt, the infantry entering the village close behind the tanks. The only strong opposition was on the extreme right of the attack, where heavy fire was encountered from the right flank. It was not till 12.15 p.m. that Lateau Wood was reported clear of the enemy.[1]

In order to save time the G.O.C. 29th Division asked permission to advance at 10 a.m., before the capture of the Brown Line. Permission was given and the division moved off with the 88th Brigade on the right directed on Masnieres, the 87th Brigade on Marcoing and the 86th on Nine Wood. The 87th Brigade encountered rifle and machine-gun fire on approaching the Brown Line, and three battalions were forced to attack it, which caused a delay of three-quarters of an hour. This gave the enemy time to

[1] III Corps Summary of Operations, Nov. 1917.
Reports on Operations, 20th Nov.-1st Dec. 2nd and 3rd Brigades, Tank Corps.

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organise some sort of defence in the part of Masnieres south of the canal. The 12 tanks and infantry working together were, however, able to gain possession of the bridge, and bridgeheads were pushed across here and at the lock just south-east of the village. The bridge had been partially destroyed and a tank which tried to cross fell through into the canal, thus preventing it from being used further. During the afternoon the infantry fought their way forward and gained possession of most of the village north of the canal except a pocket in the centre. Here a number of the enemy sheltered in the catacombs and were not captured till midday on the 21st. At 4 p.m. a squadron of Canadian Dragoons crossed at the lock and rode over the Rumilly ridge. They captured a battery but then had all their horses killed, and darkness coming on were forced to retire.[1]

The centre brigade (87th) marched on Marcoing and with the help of 8 tanks captured it without great difficulty by 12.45 p.m. securing the personal belongings of the German General in command. During the afternoon an advance was made on the Masnieres—Beaurevoir line, but this had been strongly held, and without artillery support or tanks the attack was unable to reach it except in one place, where 19 prisoners were taken, and even this position had to be given up.

The 86th Brigade and 17 tanks advanced on Bois des Neufs and reached it without delay, three tanks being knocked out by direct hits from artillery. The wood was easily captured and the tanks handed it over to the infantry, receiving a receipt for it.

All the objectives of III Corps had thus been gained west of the canal, but little progress was made east of the canal before darkness fell, and the Masnieres—Beaurevoir line and heights south of Rumilly had not been occupied as intended.

It may be of interest to enumerate some of the casualties to the tanks in what was a most successful operation without serious resistance. The 3rd Brigade, Tank Corps, which worked with the 12th and 20th Divisions, employed 146 tanks, of these 22 received direct hits, 15 were ditched, 1 sank in the canal and 16 had mechanical trouble, leaving 92 to rally at the end of the day.

[1] Report on Operations, 29th Div., 20th Nov.

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Attack of IV Corps.[1]

On the right of the IV Corps the 51st Division advanced with two brigades, 152nd and 153rd, in front, to carry the attack up to the Brown Line, and the 154th in reserve. The 62nd Division on their left had the 187th and 185th Brigades in front and the 186th in reserve. Each brigade attacked with two battalions in front, and two in support to leap-frog on the Blue Line and go through for the capture of the Brown Line.

On the 51st Division front 36 tanks were allotted for the capture of the Blue Line, and 24 more for the Brown Line including the village of Flesquieres. On the 62nd Division front 36 tanks were allotted for the capture of the Blue Line, and 12 more together with the survivors of the first objective for the Brown Line. On the west of the canal the 36th Division advanced without tanks on a narrower front, having the 109th Brigade in front and the 107th and 108th in reserve.

The hostile artillery reply to our sudden outburst was weak, and from zero hour the tanks and infantry moved forward with little check from the enemy. The Blue Line was reached and in our hands by about 8 a.m., the chief opposition being in Havrincourt park and village, where some fighting took place and it was not entirely cleared till the afternoon. The ease with which the tanks and infantry advanced through some of the most formidable wire and trenches on the Western Front was quite a new experience. As an example the right battalion of the 152nd Brigade, by the time it reached its objective beyond the Blue Line, had collected as prisoners 14 officers and 250 other ranks, whilst its casualties numbered 25. The experiences of many other battalions were not dissimilar. A pause was made on the Blue Line till zero plus 2 hours and 15 minutes (8.35 a.m.) to reorganise and allow the troops and tanks for the second objective to pass through, and then the advance to the Brown Line was continued. The 62nd Division encountered little resistance, and that portion of the line allotted to it was in its hands between 10 and 11 a.m.

The 51st Division, however, on their right, met with a stiff

[1] IV Corps Report on the Havrincourt-Bourlon Operations.
Report on Operations S.W. of Cambrai, Nov. 20th-23rd. 51st Div.
Report on Operations, 20th Nov.-4th Dec. 62nd Div.
Summary of Operation, 20th-23rd Nov. 1st Brigade, Tank Corps.

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RIBECOURT. Showing party of prisoners being conducted to cages, 20th November, 1917.

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resistance from the trenches of the Hindenburg Support Line in front of Flesquieres and from the village itself. The line here consisted of two linked trenches curving round the southern outskirts of the village and running east and west just on or behind the gentle crest. The front trench had fire bays dug in places but was not continuous and the rear trench was shallow. The trenches were supported by nests of machine guns in the high wall of the Chateau grounds, and by machine guns firing from a concrete observation post. Led by the tanks the infantry managed to get into the front trench, but in going on from here to crush down the wire of the rear trench the tanks passed over the crest and came under fire of hostile field guns which had been pulled out of their pits on the reverse slopes some 500 yards to the east and north-east of the village. 16 tanks received direct hits. It was at this place that the well-known incident occurred of a German officer working his gun by himself and disabling a number of tanks. The right hand company of the attack claimed that they succeeded in silencing the anti-tank guns by Lewis gun fire from the captured trench, but by the time they did this all the tanks had been knocked out. Several ineffectual attempts were made to advance into the village without tanks, but the machine guns and uncut wire completely checked any forward movement of the infantry throughout the day. The right battalion of the 152nd Brigade tried to organise an attack by going round through the ground gained by the 6th Division on their right and outflanking Flesquieres from the east. But it became evident that co-operation from the Graincourt direction would be required, and the difficulties of communication made it impossible to concert any arrangements before dark.

During the afternoon 7 tanks advanced to the west of the village and got into it without much resistance. The co-operation with the infantry, however, was bad, as the four platoons did not enter the village till the tanks were coming out again. The enemy, who had lain low in cellars and dug-outs when the tanks advanced, came out with their machine guns and drove the infantry out again. A patrol of King Edward's Horse operating with the 62nd Division rode into the village from the north-west early in the afternoon and reported very few of the enemy up to the middle of the village. There is no doubt that the enemy were in some strength

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to the north-east of the village and would have enfiladed an attack from the east, but a well-organised attack of infantry and tanks working from the north-west would probably have captured it any time. This check at Flesquieres had far-reaching results, as it broke up the cohesion of the attack and delayed the advance of the 1st Cavalry Division till it was too dark to do anything.

While these events were going on at Flesquieres the 6th Division on the right and the 62nd and 36th Divisions on the left swept on in the direction of Noyelles and Graincourt respectively. The 36th Division had effected an entry into the German trenches west of the canal by seizing the Chalk Spoil Heap north-west of Havrincourt. When the 62nd Divsion barrage came abreast of it they kept in line with it and these two pressed on from the Brown Line, moving up the Hindenburg Line, the Support Line and across the open country to Graincourt, which was reached and occupied about 1.30 p.m. by part of the 186th Brigade.

The two divisions, the 62nd assisted by tanks, moved on more or less unchecked capturing prisoners and material as they went, and about 4 p.m. reached the Bapaume—Cambrai road. A combined attack by two squadrons of King Edward's Horse and one company 186th Infantry Brigade on Anneux at dusk was unsuccessful owing to wire and machine guns. The troops of the 36th Division even reached the outskirts of Mœuvres. The tanks went on beyond the above objectives and cleared further trenches, but the troops of the 186th Brigade after their advance of 7,000 yards were too exhausted to accompany them.[1]

The 1st Cavalry Division which had been concentrated in the neighbourhood of Equancourt (3 miles south-west of Metz en Couture) was ordered by IV Corps at 8.25 a.m. on the successful capture of the Blue Line to move forward its head to Metz en Couture. This it did. About 11 a.m. the G.O.C. 51st Division telephoned to IV Corps that Flesquieres was in our possession and that the road from Trescault to that place was fit for cavalry. The 1st Cavalry Division was immediately informed of this and ordered to "push forward through the Brown Line, no information available about the Ribecourt road." [2] The Division at 11.2 ordered

[1] Further notes on the operations which began on Nov. 20th in front of Cambrai. 62nd Div., p. 5.

[2] IV Corps War Diary. 11.15 a.m.

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the 2nd Cavalry Brigade "to push on via Trescault to Flesquieres, road through Ribecourt may also be available." [1]

At 11.55 a.m. the G.O.C. 2nd Cavalry Brigade was informed by his liaison officer with the 51st Division that there was considerable doubt as to whether Flesquieres had been taken. He therefore ordered his advanced guard regiment (4th Dragoon Guards) which was in the hollow south-west of Ribecourt to push on towards Flesquieres to clear up the situation. At 12.30 this regiment reported that the infantry attack on Flesquieres was held up and fighting was still going on in the northern outskirts of Ribecourt. This place had been taken by the 6th Division early in the morning, but there were a large number of dug-outs in the village and some of the enemy had evidently remained in these and emerged when the attack had passed on.

At 1 p.m. reports were received that the 86th Brigade's attack on Bois des Neufs was going well. The advanced guard regiment was therefore ordered to turn Ribecourt from the south and proceed on their original line to Bois des Neufs. Owing to machine-gun fire on the cross roads south of Ribecourt from Flesquieres this move was delayed, and it was not till 3 p.m. that the advanced guard regiment reached Bois des Neufs. As this wood was reported not clear of the enemy the remainder of the brigade was halted about a mile west of Marcoing at 3.15 p.m. About 4 p.m. O.C. advanced regiment reported that Noyelles was clear, and about the same time the advanced squadron reached La Folie. Here a German H.Q. was surprised and fired into. But the regiment was counter-attacked from Cantaing and the east of the canal and fell back on to Noyelles. In accordance with orders from IV Corps, orders were issued by 1st Cavalry Division to 2nd Cavalry Brigade at 2.45 p.m. to move over the east end of the Flesquieres ridge, work round that village and capture Orival Wood. Patrols were pushed across the ridge but the enemy were found in considerable strength east of Orival Wood, and machine-gun fire across the ridge from Flesquieres continued throughout the afternoon. Nothing was therefore accomplished in this direction. The short November day quickly drew to a close, and with it disappeared the chance for the successful use of cavalry, for from next day onward resistance stiffened up very fast.

[1] Narrative of Operations of 1st Cav. Div., 20th-27th Nov.

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German dispositions.

During the day the Germans were able to bring up only few reinforcements. *Two battalions 20th Division* were sent up to close the gap near Inchy. Reserves were brought up from the *111th Division* to the same neighbourhood, and a few units from the *107th Division* newly arrived from Russia were hurried into the fight near Anneux and Noyelles.

The *20th Landwehr* and *54th Divisions* holding the line were very roughly handled, and intense confusion prevailed. The *20th Landwehr Division* lost 2,773 prisoners and was withdrawn from the line next day. Its losses were so heavy that it was never reconstituted.[1] 159 officers and 7,316 other ranks passed through the cages of the two British Corps by the evening of the 21st, the great majority of whom had been taken on the 20th. The III Corps during the same period reported 23 officers and 96 men killed and 92 officers and 973 men wounded, which gives an indication of the British losses.

NOVEMBER 21ST.

III Corps.

During the night III Corps gave instructions to 29th Division that every effort was to be made to gain possession of the Masnieres—Beaurevoir Line on the next day. At 11 a.m. the 87th (centre) Brigade made an attempt with the help of 9 tanks to take the whole of the line, but without success. The co-operation between tanks and infantry was not too good. The tanks suffered from armour-piercing bullets and the infantry came under heavy machine-gun fire.[2]

An attack by the 20th Division on Crevecœur was also unsuccessful, as the tanks were unable to cross the canal, and the infantry were held up by wire and machine-gun fire. On the extreme left the 29th Division succeeded with the help of cavalry in clearing Noyelles, and held it against a heavy counter-attack. In the evening information was received that the enemy were being considerably reinforced, instructions were therefore issued that the

[1] "Histories of 251 German Divisions in the War, 1914-18."

[2] Reports on Operations, 29th Div. and 3rd Brigade, Tank Corps. Summary of Operations, III Corps.

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ground won should be consolidated, and this was done during the succeeding days.

IV Corps.[1]

Immediately after the capture of the Blue and Brown Lines the redistribution of the machine guns and artillery of IV Corps began. The machine guns which had been in corps control up to the capture of the Blue Line reverted to their Divisions. A strong force of artillery as stated on page 213 was placed under the orders of each of the 51st, 62nd and 36th Divisions. As it was difficult to get heavy artillery across No Man's Land into the Flesquieres salient and to keep it supplied with ammunition, there being only one good road (the Metz—Trescault road) into the salient, it was decided to move the bulk of the heavy artillery to the left close to our old front line in the area Hermies—Boursies—Beaumetz lez Cambrai. This subsequently proved to be a most satisfactory arrangement, as the excellent system of trench railways enabled it to be fully supplied with ammunition, and in this position it was well placed in the event of our operations being completely successful to help in rolling up the Quéant salient. It also flanked the western side of the salient between Mœuvres and Bourlon, and later on assisted very materially in breaking up the great German attack on November 30th. The general principle of the command of the artillery was that heavy batteries moved forward into the salient came under the divisions, whilst the remainder were under B.G. C.H.A., IV Corps.

The intention on November 21st was to continue as rapidly as possible the operations outlined on page 212. The 62nd and 51st Divisions were to capture the Bourlon position. The 1st Cavalry Division was to follow up the attack and seize the passages of the Canal du Nord to the north of Inchy. The 36th Division was to continue its advance west of the canal with the 109th Infantry Brigade, whilst the other two brigades were to be held ready to seize the passages of the canal from Mœuvres up to the point allotted to the cavalry, as soon as Bourlon was taken.

Attack of 51st Division.

When day broke Flesquieres was found to be unoccupied and

[1] Report on Havrincourt-Bourlon Operations, IV Corps.

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the 51st Division entered it. Orders had been issued at 1 a.m. for the Corps to continue its attack on Fontaine and Bourlon. The 51st Division was to advance to the Marcoing—Graincourt road at daylight, and both divisions were then to move from this line at 10 a.m. to capture the main Bourlon ridge. The 51st Division reached the Marcoing—Graincourt road by 10.30 a.m., a number of guns in the vicinity of Orival Wood that the enemy had failed to get away being captured. The troops used for the attack were the 154th Brigade, who had not been in action the previous day. It advanced with 3 battalions in front and one in reserve. The tanks ordered to assist it belonged to the 2nd Brigade Tank Corps, which had been operating with III Corps on the previous day and had to come from Dessart Wood, 1½ miles south of Metz en Couture. The distance the tanks had to come made them late and the result was that the right battalion of the 154th Brigade was checked in front of Cantaing, which was held by 1,200 to 1,400 of the enemy, till 12.30 p.m., when 12 tanks arrived. These advanced straight into the village, followed by the infantry, and it was captured after some fighting, 300 prisoners being taken, whilst a large number of the enemy bolted for La Folie Wood. The 6 pr. guns of the tanks proved most effective in the village. At the request of the Tank Battalion Commander a squadron of the Queen's Bays co-operated in the attack at short notice and gave much assistance by attacking from the east.

The left battalion of the 154th Brigade, which was directed on Fontaine was first held up by the fighting of the 62nd Division for Anneux on its left, the direction of its attack being such that it would have come under our own fire if it had gone on. At 11.20 as soon as Anneux was taken it was moved forward but held up short of the Cantaing Line by enfilade fire from Cantaing on one side and Bourlon Wood on the other. It therefore dug itself in. At 2.30, 7 tanks came up and the leading companies moved forward behind them. When the tanks reached the Cantaing Line the resistance collapsed and the enemy ran or surrendered, 130 prisoners being taken. At about 3.30 this battalion and the centre batalion of the brigade advanced together on Fontaine behind the tanks. The tanks on entering the village put all the machine guns out of action and the infantry were able to take possession of it, and subsequently consolidate positions round it.

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Attack of 62nd Division.[1]

The objective of the 62nd Division was first the high ground west of Bourlon Wood and secondly Bourlon Village. There had been difficulty in getting the artillery forward during the night owing to the ground being in such a bad state from the rain which had been falling since the previous afternoon. Consequently one of the supporting field artillery brigades did not get into action till the afternoon. With this exception the artillery co-operated well. There was some delay also in the arrival of the 18 tanks of the 1st Tank Brigade, which had been resting and refitting after the previous day's fighting in Havrincourt Wood. The 62nd Division employed its leading brigade, the 186th, for the attack. The right battalion was directed on Anneux and Anneux Chapel (on the main Bapaume—Cambrai road just north of the village). The centre battalion was directed on the trench of the Marcoing Line from near Anneux Chapel to the Crucifix on the ridge between Bourlon and Mœuvres, and the left battalion on the Bourlon—Mœuvres road to the west of the Crucifix. One company with 6 tanks advanced on Anneux, 2 tanks on eack flank and two to move down the centre of the village. After some severe fighting the village was captured with 100 prisoners, but further advance was stopped at the edge of the wood by machine-gun fire.

The company for the attack on Anneux Chapel advanced down an open valley suffering severe casualties. One platoon skilfully rushed a building and put a machine gun firing from a quarry out of action, but heavy fire was now encountered from the sunken road running north-west from the Anneux Chapel (about the line on the sketch map showing the final position of the advance on 21st November). Assisted by a tank the road was reached, and 200 of the enemy who were holding it were killed or captured. The advance was then continued and the edge of the wood was reached, but as the trench of the Marcoing Line was found not to be dug but spit-locked only, the company was withdrawn to the sunken road. 300 prisoners and 13 machine guns were captured by the battalion during the day. The centre battalion also reached the sunken road, but owing to machine-gun and rifle fire was unable to get on.

[1] 62nd Div. Report on Operations, Nov. 20th-Dec. 4th.
Report 1st Brigade, Tank Corps.

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The left battalion, owing to uncut wire and the late arrival of the tanks, was unable to make its attack over the open, but launched a bombing attack up the Hindenburg Support Line. This progressed about 1,000 yards and captured a strong point and 40 prisoners, but was then held up and made no progress till 3.30 p.m. when one tank was brought up to the assistance of the battalion. With the help of this tank hostile resistance was completely broken down and the enemy fled in disorder. At 5 p.m. a strong counter-attack was made by the enemy, but was broken up by Lewis gun and rifle fire.

The reserve battalion, which had been intended to capture Bourlon Village was used after mid-day to reinforce the assaulting battalions. The attack of the 186th Brigade was thus brought to a standstill by the increasing resistance of the enemy and the exhaustion of the men. The 186th Brigade who had led the advance from the Brown Line, had in two days' fighting covered 5,000 yards in depth, and had captured 1,200 prisoners and 38 guns of all sizes.

West of the canal the 36th Division pushed forward slowly, meeting with increased opposition. Eventually it forced an entry into the south part of Mœuvres, which, though reported at one time to be captured, was never really in our hands. By dusk it was forced out of the village to a point slightly in advance of the point from which it had started.

Further on the left the 56th Division (Maj.-Genl. F. A. Dudgeon), which was holding that part of our line, kept abreast of the 36th Division by moving up the trench of the German outpost line.

Certain tanks pushed into Bourlon Wood, and the O.C. 1st Brigade Tank Corps states that it was thought that had the infantry been in greater numbers a further advance could have been made this day. But there was no doubt that opposition was much sterner, and no advance could be made without a struggle.

German dispositions.

On the 51st Division front the bulk of the shattered *54th Division* and *20th Landwehr Division* were withdrawn by the Germans and replaced by the newly arrived *107th Division*. On the Bourlon side the *214th Division* and certain *Infantry Recruit Depôts* were pushed in to stiffen the line.

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ASTOR, LENOX, AND
TILDEN FOUNDATIONS

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NOYELLES, 22nd November, 1917.

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NOVEMBER 22ND.

Late on the night of the 21st orders were issued by IV Corps for the next day's operations. The 51st and 62nd Divisions were to consolidate the positions won. The 36th Division was to take over the Hindenburg Support Line from the 62nd, and continue its advance on both sides of the canal towards Inchy. The 56th Division was to take over the Hindenburg Front Line and bomb down it.

In the subsequent operations the 36th Division was unable to gain ground east of the canal, but west of it they took the village of Mœuvres. They were driven from it, however, by a heavy counter-attack just before dusk.

The 56th Division entering the Hindenburg Line at a place already captured immediately south of Mœuvres, bombed along it under cover of an enfilading 8 pr. battery firing from east of the canal. They made over 2,000 yards, a very remarkable distance for a bombing attack, and captured the important position of Tadpole Copse, which dominated a considerable length in the Hindenburg Line.

Heavy counter-attacks were launched against the 62nd Division at about 9 a.m. and also during the afternoon. These gained ground for a time, but the enemy were finally driven back and our line re-established. An attack on Fontaine at 10.30 a.m. drove the 51st Division out of it.

The 40th Division (Maj.-Genl. J. Ponsonby) were placed under the orders of IV Corps at 8 a.m. and arrangements were made for it to relieve the 62nd Division that night and continue the attack next day.

NOVEMBER 23RD.

General plan.[1]

Under instructions from the Third Army orders were issued by IV Corps on the evening of the 22nd for a continuation of the attack on the 23rd with all its resources. The 40th Division were ordered to clear Bourlon Wood with tanks and infantry, and to attack Bourlon village from the south-west. The 51st Division was

[1] Third Army No. G.S. 56/220. 2/11/17.
IV Corps Order No. 322.

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originally ordered to work round east of the wood and assist in the capture of the village. But meanwhile Fontaine was lost and they were ordered to capture that place instead and establish themselves on the high ground north-east of it.

The 36th and 56th Divisions were to continue their advance up the Canal and roll up the Hindenburg Support and front Lines respectively, the 40th and 36th Divisions connecting up their final positions.

The front and flanks of the various attacks were to be screened with smoke by the artillery, and special attention was to be paid by the corps artillery to the ground immediately over the ridge on both sides of the wood to prevent anti-tank guns from coming into action. The Corps Machine Gun Officer was to co-ordinate the tasks of the machine guns of the divisions.

The 3rd Brigade Royal Flying Corps was to co-operate with as many low-flying machines as possible, and bombing and reconnaissance were to be the same as on November 20th.

Attack of 51st Division.[1]

Zero was fixed for 10.30 a.m., but owing to the open nature of the country the troops and tanks had to get into their assembly positions before dawn. On the 51st Division front the 152nd Brigade with 12 tanks of the 2nd Brigade Tank Corps assembled in the sunken road Marcoing—Graincourt. They advanced at 10.30 with two battalions in front, the right battalion to attack Fontaine and the high ground beyond, the left battalion the ground between the village and the wood. Each battalion advanced with two companies in front and two in support. A third battalion advanced in support with the object of forming a defensive flank east and south-east of the village. An artillery barrage was arranged to come down on the village.

The advance of the right battalion when the Cantaing line was passed was badly hampered by machine-gun fire, the right flank being exposed to heavy enfilading fire from La Folie Wood. The approach to the village was across a shallow valley swept by fire from this wood and also from the south side of the village, every house of which seemed to hold a machine gun. Repeated

[1] Report on the Operations S.W. of Cambrai, 51st Div., Nov. 20th-23rd.

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ASTOR, LENOX, AND
TILDEN FOUNDATIONS

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Tanks moving forward to attack BOURLON WOOD, 23rd November, 1917.

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attempts were made to cross this valley, but they were fruitless and the battalion had to dig in about 500 yards south of the village.

The left battalion got well on behind the tanks to the outskirts of the village. Then some hard fighting began. Directly ahead between the village and the wood the enemy made a stubborn stand, while from the right where touch had been lost heavy enfilade fire swept the advance. The machine guns to the front were tackled with energy there being many examples of individual initiative. As a result the left leading company with its support reached the north-east corner of Bourlon Wood. The right company and its support meanwhile, with the assistance of tanks, were endeavouring to enter the village. The outskirts were cleared but every endeavour by the infantry to get into the streets was baffled.

As regards the 12 tanks of the 2nd Brigade,[1] they went through the village several times. The enemy offered very great resistance, artillery and anti-tank guns had been brought up and the enemy machine guns were well supplied with armour-piercing bullets. The enemy adopted the plan of withholding his fire till the tanks were close, and then opening a very heavy fire from all sides, especially from the top storeys of the houses. 11 of the 12 tanks received direct hits during the fight, a large number of the Lewis guns of the tanks were put out of action and casualties to the crews were heavy. At the same time the enemy suffered heavy casualties from the Lewis guns of our tanks.

The 3rd Brigade Tank Corps[2] had received orders to assist the 2nd Brigade, and at 10.30 a.m. a first wave of 11 tanks advanced from Flesquieres and moved to the sunken road Marcoing—Grandcourt, where they received orders to send 2 tanks to La Folie to deal with the machine guns there, 3 to assist in clearing the eastern part of Bourlon Wood, and the remainder to Fontaine to clear that village and its vicinity and cover the consolidation. All the tanks met with great opposition from guns and from machine guns using armour-piercing bullets. The tanks in La Folie silenced the guns in the wood but could not deal with those in the chateau. They remained a considerable time dispersing parties of the enemy.

[1] Report on Tank Operations. 2nd Brigade, Tank Corps, 30th Nov.-Dec. 1st.
[2] Report on 3rd Brigade Operations, Tank Corps, Nov. 20th-27th.

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The tanks proceeding to Fontaine had 2 companies of a reserve battalion and 100 rifles from the battalions already on the ground told off to work with them. While they were assembling to enter the village the Germans counter-attacked in Bourlon Wood and drove our line back and a heavy hostile barrage came down. The advanced troops of the 51st Division on the left near the wood were compelled to fall back, and there was a good deal of confusion which resulted in touch being lost between the infantry and tanks, and the infantry were unable to get into the village. The tanks in the village had an enormous number of targets and fired a large amount of ammunition; but they were unable to hold it and in the end the survivors were compelled to evacuate it.

The 3 tanks in the wood proceeded along a road running through the wood to Bourlon Village on which the front line of our infantry rested. Our troops there were in the act of falling back, and after a great deal of firing the tanks fell back also.

A second wave of 12 tanks advanced from the sunken road at 2.35 p.m. with the object of clearing up Fontaine. They all reached their objective but not before it was beginning to get dark. They met with very vigorous resistance, being bombed and shot at the whole time. In many cases the enemy rushed the tanks and tried to prevent the guns being used by hanging on to them, and though they remained in the village till 6 p.m., they also had to evacuate it when darkness came on. The 23 tanks of the 3rd Brigade expended 43,000 rounds of S.A.A. and 500 rounds of 6 pr. ammunition. Seven of them received direct hits, 1 was ditched and 4 had mechanical trouble, leaving 11 to rally.

Little ground had been gained in this part of the field, and the high ground outside the wood and the observation still remained in the hands of the enemy.

Attack of the 40th Division.[1]

The 40th Division entrusted the clearing of the big wood to the 119th Brigade and the attack on the high ground west of it and on Bourlon Village to the 121st Brigade. Sixteen tanks of the 1st Tank Brigade were allotted to the 119th Brigade, and 13 to the 121st Brigade. There had been great difficulty in getting petrol up owing

[1] Report on Operations, 40th Div., Nov. 21st-26th.
Summary of Operations, 20th-23rd Nov. 1st Brigade, Tank Corps.

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to congestion on the Trescault—Havrincourt road, and as a result some of the tanks did not start till noon, but the remainder were timed to leave Graincourt at 9.30 a.m. so as to pass through the assaulting infantry just before zero (10.30). Visibility was poor and the preliminary movements of the tanks were not hampered by the enemy.

The infantry of the 40th Division had never seen tanks before, but they were fresh and burning to distinguish themselves. They kept up with the tanks magnificently in spite of great opposition, and fought splendidly throughout. The 121st Brigade was to advance with two battalions in front, the right battalion along the edge of the wood in touch with the 119th Brigade to attack the village from the south. The left battalion was to advance in conjunction with the 107th Brigade (36th Division), pivot on the right battalion and attack the village from the west. The support battalion was to move echelonned behind the left, ready to cover that flank. One battalion remained in reserve. The brigade advanced behind the tanks and the barrage, and very soon owing to the 107th Brigade failing to gain ground, came under enfilade fire from the left. At about 11.45 the leading waves of the right battalion were reported to have passed the ridge west of the wood, and at noon the advanced scouts to be entering the village. At 12.15 this battalion reported that it was held up on the ridge by machine-gun fire from the left, left rear and edge of the wood. About the same time the support battalion was held up by a strong point on its left which was not captured till 4 p.m. The pilot of an aeroplane who co-operated by firing into it from 50 feet was killed. The tanks at this stage suffered severely from armour-piercing bullets, 3 out of 6 allotted to the right battalion being put out of action. About 1 p.m. the support company of the left battalion which had replaced the left company on account of casualties arrived at the west side of the village, the reserve company reached the south side and the right company also entered the village with some men of the right battalion and fighting went on there. At 3.30, however, our troops were compelled to withdraw from the village and began consolidating on its southern edge.

Meanwhile the two leading battalions of the 119th Brigade had advanced from the sunken road that runs north-west from Anneux

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Chapel, and the right battalion established posts on the north edge of the wood, suffering heavy casualties in doing so. The left battalion also under heavy machine-gun fire advanced more slowly, but its left company pushed on through the village almost to the railway, and its right company reached the edge of the wood. At noon the support battalion was moved up in close support, and at 2.30 p.m. the reserve battalion was moved up to reinforce the front line. At this time the enemy artillery fire was very heavy and at 3.10 p.m. he counter-attacked in force and drove our line back into the wood near the village, but the reserve battalion attacked at once and re-established the line. There is no clear account of the action of the tanks, but there is no doubt they carried out their tasks exceedingly well, and, but for them, the infantry could not have progressed as well as they did and would have suffered much heavier casualties. At 4.45 the 119th Brigade began to dig themselves in along the crest of the ridge in the wood, a few yards inside its edge. At the same hour the enemy counter-attacked the 121st Brigade, but were beaten back at 100 yards range by small arm fire. During the night a battalion from the reserve brigade and the 15th Hussars (dismounted) were placed under the orders of the 119th Brigade, and the 9th Cavalry Battalion (formed from the 9th Cavalry Brigade) under the 121st Brigade. The enemy made repeated small counter-attacks which were all beaten off, and the situation remained as stated above.

Attack of the 36th Division.[1]

The 36th Division were to attack with the 107th Brigade and 11 tanks of the 1st Brigade Tank Corps east of the Canal du Nord, and the 108th Brigade west of it. The first phase of the operation east of the canal was to clear up the Hindenburg Support Line up to the canal and the ground between it and the canal, and to capture Mœuvres west of it. The second phase was to be an attack on Quarry Wood and a trench running from that across the canal to the neighbourhood of Tadpole Copse.

The Tank Battalion Commander entrusted with the work got his orders on the evening of the 22nd, but owing to the distances

[1] 36th Div. War Diary and Orders, Nov. 1917.
Summary of Operations, 20th-23rd Nov. 1st Brigade, Tank Corps.

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to be covered, the difficulty of finding various headquarters and other delays, only got into touch with H.Q. 107th Brigade at 5 a.m. Consequently there was little time to make proper reconnaissance or to establish proper touch with the infantry. The infantry had been holding the line before the battle, and had been in the fighting ever since and were very tired, moreover they had never trained with tanks. Finally the tanks were insufficient to deal with the exceptionally large number of machine guns. It will be seen, therefore, that the attack, which was in the nature of a trench warfare operation, did not start under very favourable conditions.

West of the canal Mœuvres was taken by 6 p.m., without the help of tanks, but a heavy counter-attack drove the 108th Brigade out of it again. East of the canal for the first phase 6 tanks were employed. Two were to clear the Hindenburg Support Line, 2 were to deal with a detached work "Round Trench" half way between that and the canal, south-east of Mœuvres, and 2 were to work up the canal bank. The infantry, owing to the intensity of the small arms fire, were unable to keep up with the tanks, which cruised about fruitlessly all day. They inflicted considerable losses on the enemy, but they accomplished nothing permanent and themselves suffered very heavy casualties. 55 per cent. of the personnel were killed, wounded or missing. One tank lost its way and was never seen again, one was ditched in the enemy's lines, five received direct hits, and four rallied after the fight. Short accounts of the action of each tank taken from their "Battle History Sheets" are available, and it will be of interest to quote some of them.

"Eradicator II" (2nd Lt. Briant).

We left Graincourt at 8.30 and proceeded to Canal Trench. We established touch with our infantry who followed us a certain way, but owing to heavy machine-gun fire could not follow us all the way to Lock 5. We continued along Canal Trench and reached Lock 5 where we came under heavy machine-gun fire, we answered this with Lewis gun fire but could not get quite close to the lock owing to a small piece of marshy ground, but we quelled the fire and waved the red and yellow flag (signal for infantry to come on) but the infantry were unable to come up and consolidate. We

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patrolled this neighbourhood till 1 p.m. and then we joined with tanks from 15 Company and proceeded toward Quarry wood; we fired at Round Trench in passing but we saw two other tanks there and went on. We saw none of our infantry beyond Round Trench so waited about that and Hindenburg Support firing at the latter till dusk, when we rallied. We used up practically all our ammunition.

"Eve" (2nd Lt. Fairbank).

I moved off at 10.20 a.m. for my first objective and after proceeding a short way was stopped by Capt. Roberts who told me to go to Round Trench which was still holding out, I reached there at 10.45 a.m., went straight into the wire and opened on the enemy who were there in strength, but continually moving from trench to trench. I travelled right across the strong point several times, killing many Germans. I observed a small party of British troops in shell holes some way forward of Round Trench and went up to them, they turned out to be the crew of "Esme" who had evacuated. I was at and about Round Trench until about 3 p.m., as no infantry were there I sought out an infantry officer and took him up in my tank to show him what was in front of him. He said he had only a very depleted company and that in his opinion it would require at least a battalion with two companies in reserve to take the trench. I asked him what he wished me to do and he said "Wait until I have interviewed my Colonel and I will then let you know." I went on rolling out wire in the interval. A few minutes later I got a direct hit from a field gun which set my tank on fire, I evacuated and remained in shell holes until dusk, when I returned.

"Eclipse II" (Pte. Dove, 1st Driver, the only survivor).

After crossing our front line our tank bore slightly to the right and continued straight ahead about 150 yards to the right of "Explorer," almost immediately a fierce machine-gun fire was directed on the tank. The tank then headed for a light iron bridge about 1,000 yards from our front line. Half way across No Man's Land "Explorer" was lost sight of. About 350 yards from the iron bridge every gun was out of action, the 6 pr. on the right had a broken hammer. The tank immediately swung towards our lines, and Corpl. Hilling having rectified the gun on the right, carried on.

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Five minutes later at 11.45 a shell passed through the rear end and exploded on the left side practically level with the front of the engine, setting the camouflage net on fire. Lt. —— and all the crew were killed or wounded. I stayed with the tank until ordered in by 2nd Lt. Fairbank.

"Explorer" (2nd Lt. Lenard).

I crossed our front line at zero and proceeded straight to the enemy position at Round Trench, at this time there was practically no enemy barrage. When 200 yards from the southern face of Round Trench we came into a perfect hail of machine-gun fire and my front Lewis gun was immediately put out of action. The two 6 prs. at this time were doing very good work on the dug-outs at Round Trench and also at Lock 5. As we reached the wire we had perfect targets as the trenches were fully manned, and we inflicted heavy casualties on them. I gave orders to my gunners to use the grape shot and when we opened with this the Boche put their hands up. I signalled to my left gearsman to hoist the red and yellow flag to show our infantry the trench was ours, but they did not come on, the enemy then picked up their rifles and reopened their fire. Capt. Roberts, my section commander, was wounded at this stage but continued to supply me with ammunition for the forward gun. I then had three of my gunners and one of my gearsmen, all out of action. I was only able to get one 6 pr. and one Lewis gun going, one of my 6 prs. went with a broken hammer very soon and another Lewis gun was hit. I had also used up all my ammunition. Capt. Roberts told me to drive the tank back and refill. I think we must have killed from 300 to 400 Germans.

German situation.

On the German side in front of the 51st Division after the heavy fighting of the two previous days the *107th Division* was withdrawn on November 22nd and replaced by the *119th Division,* and the *Arras Group* on the Bourlon front received the *21st Reserve Division* by train as a counter-attack division as well as several aeroplane squadrons.

On November 23rd the *Arras Group* began to receive the *3rd Guard Division,* some of whom were pushed into the fight the same

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day. By this time this group consisted of six divisions, viz.: *111th, 240th, 20th, 214th, 21st Reserve* and *3rd Guard Infantry*, of which the first two were north of the IV Corps front. In addition it had by now 200 guns and 7 squadrons of aeroplanes. It will be seen, therefore, that the British divisions were by now up against strong opposition.

To sum up, our line by nightfall included Bourlon Wood and the day's operations had resulted in some gain of ground in the centre, but the resistance had been fierce and the casualties considerable. The Germans also acknowledge that they suffered heavily, especially among the infantry. Orders were issued for the Guards Division to relieve the 51st during the night, and the latter were withdrawn and transferred to V Corps for rest.

NOVEMBER 24TH.

At 12.50 a.m. IV Corps[1] issued orders for the ground gained to be held at all costs. The 40th Division to consolidate their position and attack Bourlon Village with the aid of 12 tanks of the 3rd Brigade Tank Corps at noon, the Guards Division to consolidate the line taken over from the 51st Division; and the 36th and 56th Divisions to continue their clearing of the Hindenburg Line. The day consisted of a series of attacks and counter-attacks, the fighting taking place mostly in Bourlon Wood. At 8.45 a.m. a heavy attack was launched against both flanks of the 119th Brigade. This attack only succeeded in forcing a few of our advanced posts back and was completely repulsed by artillery and small arms fire, the advanced posts being re-occupied.

The enemy's artillery, however, continued very active and at 11 a.m. another serious counter-attack was delivered against the right flank of the 119th Brigade. This attack was caught by our artillery and suffered severely, but still came on and succeeded in driving in the right flank considerably. At 3 p.m. a fresh counter-attack on a large scale was launched and succeeded in forcing the Brigade back to a line facing east in the middle of the wood. But a counter-attack was organised consisting of a battalion, the dismounted 15th Hussars and men from all units of the brigade. This

[1] IV Corps Report on Havrincourt-Bourlon Operations.
Report on Operations, 40th Div., 21st-26th Nov.

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succeeded in re-establishing our line, and we again held the high ground in the wood with posts along its north edge and along the south edge of the village.

The Corps Commander, who arrived at Divisional H.Q. during the morning, decided after consultation with the G.O.C. 40th Division that it would be better to defer the attack on Bourlon Village till the morning of November 25th, as the 12 tanks available might not be sufficient, and delay would give time to get more ready. Orders were consequently sent cancelling the attack at 3 p.m. Owing to the wires being cut between the division and the brigades this message did not arrive, and the Brigade Commander, 121st Brigade, rightly decided to carry out the attack as ordered. He was in close touch at Graincourt with the commander of the 12 tanks and with the artillery group commander covering his front. The attack, assisted by tanks, took place at 3.30 p.m. and was successful. The 14th H.L.I. attacked on the right, the 12th Suffolk on the left and both gained their objectives on the north side of the village. Owing to the confusion of village fighting touch was lost between the two battalions, and the 12th Suffolk were driven back to the south edge of the village, the H.L.I. remaining and consolidating along the railway, with both flanks exposed.

The situation then was that three companies H.L.I. were isolated on the railway, and two companies 12th Suffolk were in a German trench running round the north and north-west of the village, while the Germans were in the village itself. A battalion and a half of the reserve brigade and the 1st Cavalry Regiment (dismounted) were then placed at the disposal of the Brigadier, 121st Brigade. It was hoped to mop up the village next morning with these and with the help of 12 tanks, but these tanks were not forthcoming, and the German attacks next day prevented the village ever being cleared. On the front of the 36th and 56th Divisions the Germans again attacked from the direction of Inchy through Mœuvres, but this attempt was broken up by the artillery of those two divisions. On the Guards front matters were quiet.

German situation.

During the day the *221st Division* and more batteries and aeroplanes arrived to reinforce the *Arras Group*, the guns of which had now risen to 300. The German infantry, officers and men, were

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very exhausted by the continuous fighting and the bad weather; but nevertheless counter-attacks were planned on Bourlon village and wood to prevent the British breaking out northwards, as it was feared that this would mean the loss of 50 German batteries which were in position near the railway.

NOVEMBER 25TH.

During the morning the Germans attacked Bourlon village heavily and were helped by numbers of their men who came up out of the cellars and dug-outs in the village. After fighting which lasted all day our troops were driven out of the village to the southern outskirts and the 14th H.L.I. were permanently cut off.

Early in the morning the 119th Brigade were also attacked on their right, but with the help of two battalions of the Guards Division which had been placed at their disposal they held their ground through heavy fighting which continued in the wood all day. The 62nd Division were ordered to relieve the 40th Division, who had had severe casualties, this night.

German situation.

On this day the German *XVIII Corps* took over the *111th* and *140 Divisions* on the right of the *Arras Group*, the *49th Reserve Division* arrived on the front, and the *Second German Army* gave orders for preparations to commence for the great counter-attack which eventually took place on November 30th.

NOVEMBER 26TH.

There were no operations on the 26th and matters were quiet along the whole front. The enemy shelled Graincourt and various other spots. A conference was held at 62nd Division H.Q. at 9.30 a.m. at which the Corps Commander IV Corps and G.O.C's Guards and 62nd Division were present. The Army Commander, Third Army, and the Commander-in-Chief visited 62nd Division H.Q. during the conference. It was determined again to attack the Bourlon position on the 27th with the object of gaining the high ground above Fontaine from which the enemy could observe our gun positions north of the Flesquieres ridge. The Guards were to attack Fontaine and the 62nd Bourlon with the help of tanks, the 62nd in addition having three dismounted battalions of the 2nd Cavalry Division placed at their disposal.

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The 36th Division were now ordered to withdraw to rest, to be replaced by the 2nd Division, and the 47th Division were ordered to move forward into the Beaumetz area and later to the neighbourhood of Graincourt.

NOVEMBER 27TH.

Attack of Guards Division.[1]

At 6.20 a.m. after a night of snow and tempest the attack was launched and fierce fighting ensued all day. Three battalions of the 2nd Guards Brigade advanced against Fontaine assisted by 12 tanks of the 3rd Brigade Tank Corps, and covered by a creeping barrage from six brigades R.F.A., which advanced 100 yards in five minutes, while heavy standing barrages were placed on La Folie Wood and all the approaches to Fontaine. Almost immediately the right battalion came under heavy machine-gun fire from the outskirts of Fontaine, whilst the centre battalion pushed on for some distance before it came under heavy fire from its left flank and from the railway in front. The left battalion suffered severe casualties from fire from a strong point on its left. But in spite of the opposition all the battalions reported about 8.30 a.m. that they had reached their objectives, but were very weak owing to casualties. These casualties in the case of the two right battalions prevented the proper mopping up of Fontaine. Tanks moved about the village doing what they could, but there were at least two field guns in it for anti-tank defence which were a great difficulty. The enemy were in large numbers everywhere and at one time over 1,000 prisoners had been captured, but owing to the small numbers available for escort only about 600 reached the divisional cage.

The left battalion in the wood also met great numbers of the enemy, killed many of them and took many prisoners, but it reached its objective so weakened that it could not afford to send large escorts back and many prisoners escaped owing to the thickness of the undergrowth. On arriving at the edge of the wood the battalion came under very heavy fire from field guns.

On hearing at 8.30 that the battalions had reached their objectives but were very weak the Brigadier of the 2nd Guards

[1] IV Corps Report on Bourlon-Havrincourt Operations.
Narrative of Operations, Guards Div., Nov. 9th to Dec. 6th, 1917.

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Brigade moved a battalion to reinforce them and asked for another to be placed at his disposal, which was done.

Meanwhile the Germans developed very strong counter-attacks, one in the wood, one against the station, and one from La Folie against the south-east of Fontaine. The first found a gap between the left and centre battalions and managed to drive in the greatly weakened left company of the latter. The second was repulsed, but the third from La Folie succeeded in entering Fontaine. As a result the enemy, who reinforced his successes, was behind our troops and in a position to cut off all three attacking battalions, and the Brigadier, 2nd Guards Brigade, ordered their retirement to the original jumping-off line. The whole three battalions now numbered only 460 men, and during the night they were relieved and moved back into reserve.

Owing to the strong opposition the tanks had a very severe time. A Tank Corps officer told the writer at the time that his tank came out of Fontaine village with Germans swarming all over it trying to fire through the loop-holes. While another told him that being in Bourlon Wood in a tank was like being in a greenhouse in a hailstorm. The crews had small cuts all over them caused by flakes of steel off the inside of the tanks.

Attack of the 62nd Division.[1]

The plan of the 62nd Division was to attack with two brigades, the 186th on the right against the part of the wood and railway east of Bourlon village, and the 187th on the left against the village. Each brigade was to be given one battalion from the 185th Brigade. The 186th Brigade was to have four tanks of the 3rd Brigade Tank Corps, and the 187th Brigade for the capture of the village was to have 16 tanks. The whole was to be covered by a rolling barrage from five brigades of field artillery. A smoke screen was to be put down to cover the left, and a Heavy Artillery bombardment was ordered on Quarry Wood and Marquion Trench. It was impossible to bombard Bourlon village as parts of the 40th Division were thought to be still holding out in it. As a matter of fact, during the late evening of the 26th an officer of the 120th Brigade arrived at the H.Q. of the 185th Brigade and reported that

[1] Report on Operations, 62nd Div., Nov. 20th-Dec. 4th.

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the H.Q. of the 13th East Surrey Regiment and 200 men of the 14th H.L.I. were still in some buildings in the south-east of the village where they had defended themselves for two days. Steps were immediately taken to get in touch with these troops and during the night they were extricated from the village and brought back to Havrincourt.

The fighting was of so confused a nature and the opposition so severe that it is difficult to follow what happened. The 186th Brigade advanced with two battalions in front, the right one to go through to the railway, the left one to go only to some outlying houses on the east of the village. At these houses the supporting battalion was to leap-frog through the left battalion and go on to the railway also. At 6.20 when the attack started it was still dark and the enemy put down a very heavy barrage on Bourlon Wood and the forming up places. The right battalion of the 186th Brigade was met by intense machine-gun fire from an enemy strong point opposite its right flank and made little progress, the left battalion seems to have swung to its left and to have been brought to a standstill facing the south-west edge of the village, followed by its supporting battalion. This was the situation at 10.30 a.m., but by the afternoon the brigade was in possession of the above mentioned outlying houses and the north edge of the wood. Finally about 4.30 p.m. a strong counter-attack accompanied by heavy shelling drove our troops right back into the wood.

The 187th Brigade was also to advance with two battalions in front and one in support. The left was to be covered by four tanks and one company of infantry moving wide on the flank, but the tanks unfortunately lost their way and moved straight forward, with the result that the attack suffered severely from fire from the left. It nevertheless got half way through the village, where the streets were found to be barricaded and impassable for tanks. Some field guns and heavy machine-gun fire were also encountered which brought the attack to a halt, and by 9.30 a.m. our infantry were again out of the village.

The description of the action[1] from the point of view of the tanks adds little to our knowledge. It states that the infantry suffered so severely from machine-gun fire from the flanks that they

[1] Report on 3rd Brigade, Tank Corps, Operations with Third Army, Nov. 20th-27th.

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were unable to follow the tanks. In some cases no infantry officers were left. Some parties, however, reached the railway but were compelled to retire. Of the 30 tanks which were employed, 13 rallied in good condition, 6 received direct hits, 2 were ditched, 5 were missing and 4 had mechanical trouble. During the night the leading troops of the 186th Brigade were relieved by two dismounted battalions of the 2nd Cavalry Division, and the 187th Brigade by the 185th.

German situation.[1]

The German description states that the British attack at Bourlon fell on the *21st* and *221st Divisions*, the latter of which had relieved the *3rd Guard Division*. It acknowledges that the British reached the embankment beyond Bourlon and also took Fontaine, but that they were driven back into the wood, and Fontaine was retaken by the *Caudry Group*.

The resources of the Third Army at this stage[2] did not permit of the offensive being continued any longer. The 47th and 59th Divisions were placed at the disposal of IV Corps for the relief of the 62nd and Guards Divisions when required. The tanks were ordered to be withdrawn altogether.

NOVEMBER 28TH AND 29TH.

Except for heavy gas shelling of Bourlon Wood, and much shelling generally, the situation remained unchanged during these two days. Owing to the thickness of the undergrowth the gas hung about badly in the wood and caused many casualties.

The Guards Division was relieved by the 59th Division (Maj.-Genl. C. F. Romer), and the 62nd Division by the 47th Division (Maj.-Genl. Sir G. F. Gorringe). The 2nd Division (Maj.-Genl. C. E. Pereira), which had relieved the 36th Division, made a small gain of ground on the left. The new divisions busied themselves at once strengthening their positions, as it was generally felt that a big enemy counter-attack could not be long deferred.

[1] Von Moser, "Feldzugs-Aufzeichnungen, 1914-18."

[2] IV Corps, Havrincourt-Bourlon Operations.

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CANAL DU NORD near MŒUVRES, 28th November, 1917.

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NOVEMBER 30TH.

It is not proposed to describe the events of the great German counter-attack in detail, as the affair was on so vast a scale and no new methods were employed; while the tactics on the British side were defensive and tanks were only employed to a small extent.

The German plan.[1]

The orders for the counter-attack were not issued to the Groups concerned by the *Second German Army* till 25th November, and it was a fine piece of staff work for them to have mounted so big an attack after only five days preparation. The general plan was for the *Caudry* and *Bussigny Groups* to advance with about 12 divisions from the line Rumilly—Vendhuille at 7.50[2] a.m. to the line Trescault—Fins. The *Arras Group* with five divisions to attack at 10.50 west of Bourlon in the general direction of Graincourt, while the *3rd Guard Division* tried to pinch off Bourlon Wood. The objective was a limited one but served a double purpose:—

(1) To throw the British back on the defensive, recapture the ground south-west of Cambrai, and prevent them taking that town.

(2) To capture prisoners and guns.

Most was expected from the southern attack, and it was put in three hours earlier than the northern one to try and induce the British to withdraw troops from the front of the latter. The attack was helped by a mist in the early morning, and on the south side by the fact that our positions above the Canal de l'Escaut were on the top of convex slopes which prevented our troops seeing the Germans massing in the valley below.

The southern German attack.[3]

The southern German attack fell on the following divisions counting from the British right:—The 55th Division (Maj.-Genl. H. S. Jeudwine) belonging to VII Corps (Lt.-Genl. Sir T. D'O. Snow) which held a very long front of something like 12,000 yards just south of the battlefield, and the following divisions of III Corps

[1] Von Moser.

[2] British time.

[3] Summary of Operations, III Corps.
Divisional Histories.

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which had taken part in the attack of 20th November, 12th, 20th, and 29th.

Great activity on the part of the enemy and a large amount of artillery registration had been noticed during the previous days, so that the attack was not unexpected and the G.O.C. of the 55th Division and other local commanders had taken such steps as their means permitted to prepare for it. The attack was preceded at 7 a.m. by a very heavy bombardment and was carried out in tremendous force and with great rapidity, assisted by a large number of low-flying aeroplanes. It was checked on the extreme right before it reached Epehy, and the important Epehy—Villers-Guislain ridges which gave access to the Fins valley. But on the left of the 55th Division, and at its junction with the 12th Division at the Banteux Ravine, the enemy broke through in great force, seized Villers-Guislain, Gonnelieu, and later advanced on Gauche Wood and Gouzeaucourt, which places they held by 10.30 a.m. Further to the left the attack on Lateau Wood forced the 12th Divsion out of it and onto Welsh ridge. The attack on the 20th Division still further to the left in the salient above Crevecœur developed from the south and the troops holding the line were assailed in front, and at the same time found themselves with the enemy advancing on their right rear. The line was overwhelmed and the two brigades of this division fell back fighting to the eastern slopes of the Welsh Ridge.

This dangerously exposed the 29th Division who held Masnieres, Marcoing and a position east of the canal. At one time Les Rues Vertes, the part of Masnieres west of the canal, was lost; but the 29th Division regained it by a counter-attack and held their ground as the result of desperate fighting. At 11.25 a.m. the situation was reported as follows :—The enemy held Lateau Wood and 1000 yards beyond it, La Vacquerie, Gonnelieu, Gouzeaucourt and Villers-Guislain and were still advancing west through Gouzeaucourt. On the right of III Corps details under the command of the Brigadier, 35th Brigade, fell back fighting a rearguard action through Gauche Wood and with the help of two battalions which came up from the direction of Fins checked egress from that. They were later joined by the 2nd Cavalry Division which came up on their left and a line was then formed. All along the front batteries

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firing at close range over the sights and details of all kinds had by this time gradually checked the German onslaught, but the loss in prisoners and guns was heavy.

The British counter-attack.[1]

The only considerable body of troops immediately available for counter-attack was the Guards Division which was resting about Metz and to the west of it. This was at 8.30 a.m. put at the disposal of VII Corps and at 11 a.m. was transferred to III Corps, who immediately issued orders for it to advance on Gouzeaucourt. The G.O.C. Guards Division on hearing that the Germans had broken through near Gonnelieu had already at 10 a.m. given orders to the 1st Guards Brigade to occupy the ground east of Gouzeaucourt. The only other order, therefore, that was necessary was to direct the 3rd Guards Brigade to advance on the left of the 1st Guards Brigade and drive the enemy back from the line Gouzeaucourt—Villers Plouich. This was given verbally through a staff officer.

The Brigadier and Commanding Officers of the 1st Guards Brigade, riding forward to reconnoitre, met a large number of our troops retiring in disorder, and learnt from them that the enemy was in occupation of Gouzeaucourt. As the head of the brigade reached Gouzeaucourt wood about noon it was ordered to form up for the attack, which it did with three battalions in front and one in reserve, the objective given verbally to the commanding officers being the high ground east of Gouzeaucourt. The brigade swept on without artillery support in the face of considerable machine-gun fire, and by 1.30 p.m. was in possession of the objective including the village of Gouzeaucourt. The 20th Hussars (dismounted) attacked on the right of the 1st Guards Brigade, and later a cavalry regiment (mounted) made a gallant attempt to get round the enemy's left, but was prevented from doing so by wire and machine guns. Further to the right the mixed force already mentioned under the Brigadier, 35th Infantry Brigade, also advanced with the help of 14 tanks. On the left the 3rd Guards Brigade advanced and occupied the line Gouzeaucourt—Villers Plouich[2] as ordered. Twenty-two more tanks of the 2nd Brigade Tank Corps which were lying

[1] III Corps Summary of Operations.
Narrative of Operations, Gds. Div., Nov. 9th-Dec. 5th.
[2] 2nd Brigade, Tank Corps, Report on Tank Operations, Nov. 25th-Dec. 1st.

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east of Fins waiting to entrain were ordered to assist in the capture of Gouzeaucourt, but arrived too late. They helped, however, to consolidate the ground recaptured, and the arrival of the tanks at a critical stage of the battle undoubtedly had a stimulating effect on our troops and demoralised the enemy. As a result of these combined efforts the situation was made secure.

The next morning, December 1st, the 5th Cavalry Division with 17 tanks and the Guards Division on their left were ordered to attack the Villers Guislain—Gauche Wood—Gonnelieu ridge. The wood was taken after very heavy fighting, and a line consolidated to the east of it which was continued northwards 200 yards west of Gonnelieu. On this line the battle stabilised itself.

The northern German attack.[1]

General von Moser states that the *Arras Group* for this attack was to consist of six divisions, the *49th Reserve, 20th, 21st Reserve, 214th, 3rd Guards* and *119th,* with 508 guns, a ration strength of 130,000, which he proudly remarks was the same as the Crown Prince had for the Battle of Worth on August 6th, 1870.

The *49th Reserve, 214th* and *221st Divisions* assembled for the attack at 8 a.m. under cover of a smoke screen which, judging by results, was not very effective. By 10 a.m. reports reached the German headquarters that the British artillery were firing on the attacking divisions and inflicting heavy losses, but by 10.20 a.m. they reached the position of assault and the 500 German guns increased their fire to a hurricane. At 10.50 all the divisions assaulted simultaneously and the fighting planes appeared to machine-gun and bomb the British.

The course of the battle as it appeared from the British point of view was as follows.[2] Between 9 and 10 a.m., shortly after the news had been received of the attack on III and VII Corps, news began to reach IV Corps headquarters from various observers that very large bodies of Germans were massing against the western flank of the salient. A whole division was reported as moving into Mœuvres, while battalions and regiments were moving in waves

[1] Von Moser.

[2] Havrincourt-Bourlon Operations, IV Corps.
Divisional Histories, 2nd and 47th Divs.

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across the open slopes between Mœuvres and Bourlon. Two batteries were reported as having come into action in the open on those slopes. These were at once overwhelmed by our artillery, and only fired one and three rounds respectively. It was soon clear that the object of these troops was to attack the left face of our salient, with a view to pinching it in conjunction with the attack on Gouzeaucourt. The situation now was an exceedingly anxious one. The enemy, having broken through near Gonnelieu, were threatening Metz, a vital spot in the communications to the newly-won area north-east of Havrincourt, in which four divisions and many brigades of artillery were assembled; in fact rifle fire was actually falling on the Metz—Trescault road, the only good road into this area. At the same time this other great attack was coming on against the opposite flank of the salient. Everything now depended on this flank of the salient holding out. Fortunately the German attack was delivered on the ground most favourable to us, and the 2nd and 47th Divisions defending it rose magnificently to the occasion. The greater part of the IV Corps heavy artillery had been moved into the area Hermies—Louverval—Beaumetz as already stated, this with the VI Corps heavy artillery to its left was in a position to take the attacks in flank, whilst a very powerful mass of field guns in action south of Graincourt and on both sides of the canal were able to receive them in front. The position of our machine guns also was most favourable. Two batteries of these belonging to the 47th Division in position west of Bourlon Wood fired west and took the advance in flank, while four batteries along the Bapaume—Cambrai road took each wave in front as it showed over the crest. On the 2nd Division front also the machine guns were well placed. The guns of two companies were along the canal from which place they more or less enfiladed the right of the attack, one of them firing 100,000 rounds; while a battery of eight guns further to the right fired 70,000 at close range.

The attack on the east side of the canal began soon after 9 a.m. and fell on the left of the 140th Brigade, 47th Division, which held the crest of the ridge just west of Bourlon Wood, on the 99th Brigade and 6th Brigade of the 2nd Division, the last-named of which held a position astride the canal. In spite of the accurate fire of our artillery the attack came on time after time only to be

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hurled back by the fire of guns and small arms and the magnificent fighting of the infantry, often at the closest ranges. Great attacks were delivered at 9.20 a.m., 11.25 a.m. and again at 2.30 p.m. Reports were received at various times that the enemy had reached the Bapaume—Cambrai road, and two reserve battalions of the 2nd Division were ordered up to counter-attack; but as a matter of fact he never really dented our line, and only took a few advanced posts, and forced us back some two or three hundred yards on the crest near the wood in the afternoon. On the west of the canal the attack was met by the 6th Brigade. Here the ground was much intersected with trenches, and the attacks largely took the form of heavy bombing attacks. The enemy forced our troops back a few hundred yards, and this was all the gain he effected.

More than three divisions attacked on this front. All day long they came on against our troops who were well prepared for them, and received them with a combined and intense fire of all arms. The guns and machine guns were in many cases run up on to the crest to fire direct over the open sights, and fired all day against such targets as their detachments had never seen before, while there was no lack of ammunition. There can be little doubt that the enemy's losses were very serious. As a proof it may be mentioned that German burying parties were still on the slopes below Bourlon Wood six weeks later in January.

Attacks were also delivered against the north and east of Bourlon Wood by the *3rd Guard Division*, and between Fontaine and Cantaing by the *119th Division*. These were met by the 59th Division and the left of the 6th Division of III Corps. They were beaten off by artillery fire, and except for shelling the 47th and 59th Divisions were undisturbed throughout the rest of the day.

As a precautionary measure the 59th Division early in the day were ordered to form a defensive flank on the Welsh Ridge and across the Flesquieres ridge with two battalions which eventually gained touch with the left of the Guards Division after their attack. Four brigades of field artillery were ordered behind the Hindenburg Support Line near Flesquieres and four batteries of heavy artillery from near Flesquieres to south-west of Havrincourt, to be prepared to form a defensive flank towards the east or cover a retirement through the Hindenburg Support Line if required. But fortunately

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the counter-attack of the Guards Division at Gouzeaucourt and the splendid stand of the 2nd and 47th Divisions had shattered any hopes that the enemy may have had of success on a great scale.

THE WITHDRAWAL FROM THE BOURLON POSITION.

As soon as the German counter-offensive had been stayed, the question of withdrawal from the exposed and dangerous salient at Bourlon had to be taken up. There has been a good deal of controversy on this subject caused by the exaggerated value given on the Western front to the retention of pieces of ground, often unfavourable, for the simple reason that they had once been held. As a matter of fact the withdrawal from Bourlon as a permanent position was a foregone conclusion from the moment that it was decided not to prosecute the attack on the high ground east of the Canal de l'Escaut to the north and south of Rumilly. As explained, the country north of the Flesquieres ridge is a cup overlooked from the high ground north of Fontaine and also from that near Rumilly, behind which there are innumerable hostile gun positions. Several attempts were made to capture the high ground north of Fontaine without success, but even if this had been taken it could never have been held, as it was enfiladed from the high ground east of the canal. The situation might have been alleviated if progress could have been made towards Inchy and Quéant. But when we failed to gain ground there, it left the Bourlon salient a death trap in which it would have been impossible to keep troops, especially artillery, without great loss, and without the continual danger of their being cut off.

On the evening of December 1st V Corps Staff (Lt.-Genl. Sir E. A. Fanshawe) relieved IV Corps Staff, and in conjunction with III Corps carried out the withdrawal on the night of 4th/5th December. As a result of careful preliminary arrangements it was carried out without molestation or loss. The main line of resistance to which the two corps fell back was on the right facing east the line on which the German attack was brought to a stand on December 1st as far north at the Welsh Ridge. From there it followed the Hindenburg Support Line across the Grand Ravine on to the Flesquieres ridge, along that and across the Canal du Nord to a point in our old front line west of that village. This was a good position and we remained in it till the great German

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attacks in March 1918 broke in to the north and south and forced us to evacuate it.

The prisoners taken by the two corps between November 20th and 30th amounted to 182 officers and 9,592 men, of which IV Corps took 118 officers and 6092 other ranks. In addition a large number of the enemy must have been killed and wounded in the heavy fighting round Bourlon Wood, and in the great German counter-attack of November 30th. The losses of the two British corps were[1] :—

	Killed.	Wounded.	Missing.
III Corps ...	811	4,232	957
IV Corps ...	1,706	9,346	2,728
Total ...	2,517	13,578	3,685

The following weapons were captured :—

	Guns.	Trench Mortars.	Machine Guns.
III Corps ...	58	34	71
IV Corps ...	65	45	210
Total ...	123	79	281

The long drawn out wearing down of the German armies had been carried a step further. The advantage during the first two days had been very greatly on our side, and in the subsequent fighting it is not unreasonable to suppose that the losses were fairly evenly divided. Both sides attacked in turn and neither side had an advantage as regards entrenchments, while the British infantry had the protection of tanks in the attack. Far more important, however, than any immediate gains and losses was the proof that surprise was again possible and that methods had been demonstrated by which the deadlock on the Western Front might be ended.

Some Lessons.

The value of reserves.

Much can be learned from the Battle of Cambrai of the use of reserves. There can be little doubt that, if two fresh divisions with their proper complement of tanks had been available outside Bourlon Wood on the afternoon of November 20th when the

[1] Havrincourt-Bourlon Operations, IV Corps.
Summary of Operations, Nov. III Corps.
War Diary, ,, ,, ,,

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infantry of the 62nd Division, after their splendid advance of 7,000 yards, were unable to follow the tanks further through sheer exhaustion; a very much greater local success might have been obtained. That afternoon two divisions advancing north-west would have gone a long way towards rolling up the Queant salient and capturing the troops and guns in it. Even next morning they could have done a great deal, though possibly not so much.

It had been hoped to accomplish these results by means of the cavalry, but the event proved that the moral of the enemy was far too high for cavalry to accomplish anything under the conditions of the Western Front. At the time there was a very strong argument against having more troops close up than was necessary, namely the difficulty of concealment and the danger of the whole concentration being discovered. But it is possible to see now that the 40th and Guards Divisions might have been brought close up beforehand or even brought up in lorries on Y/Z night,[1] and they would have accomplished very much more on Z day than they did three or four days later.

As regards the tanks, practically the whole of them were put into the first attack up to the Brown Line. In this case it is also easy to be wise after the event and to see that fewer tanks could have accomplished the result,[2] especially on the III Corps front. A reserve might have been kept which would have been of the utmost value for subsequent operations. There were very strong arguments, however, for the course that was adopted. Very little was known as to how many tanks would be required to capture the strong entrenchments of the Hindenburg Line, and the first necessity was to break the crust. It was hoped that all might be plain sailing afterwards. The obvious thing, therefore, was to make sure of the first step, and use all available tanks for it.

The leap-frog system was used throughout wherever it was intended to go to any depth, and was most successful. There were, on the other hand, no instances of reserves being successfully used according to developments. The system of retaining reserves to be employed according to circumstances may be advisable in encounter

[1] Notes on operations commencing Nov. 20th, 62nd Div.

[2] Summary of Operations, 20th Nov.-23rd Nov., 1st Brigade. Tank Corps "Tactical formations."

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battles or guerilla warfare. But where shelling is heavy, communication difficult and headquarters unable to function close up to the fighting, reserves will remain unused and the opportunity will pass by, unless they are given a rôle in the original plan. Another argument in favour of the leap-frog system and a continuous advance is that any new attack requires new arrangements for artillery support, which take time and cause delay, and thus give opportunity for resistance to stiffen up. This argument will lose some of its force if tanks become numerous and every body of troops has its allotment of armoured vehicles ready to advance with it and cover it; but experience shows that the leap-frog system is superior to the other if it can possibly be used.

Surprise.

The whole plan of the battle was drawn up in order to make the utmost use of surprise, and surprise was so important that it may seem waste of time to make any mention of it. But it is worth while to draw attention to two aspects of the subject. The first is the exceedingly fleeting nature of the effects of surprise in a well-organised theatre of war against an enemy of the first class. The commander-in-chief stated[1] that he did not expect many hostile reinforcements under 48 hours. As a matter of fact reinforcements arrived before that time. Not many were pushed up on November 20th—only a few units of the newly-arrived *107th Division* from Russia near Anneux and Noyelles, and two battalions of the *20th Division*, which was holding the line near Queant, and reserves from the *111th Division* to the neighbourhood of Inchy. On the 21st November the *107th Division* relieved the two shattered divisions (*20th Landwehr* and *54th Divisions*) south of Bourlon Wood, and the *214th Division* and certain *Infantry Recruit Depots* were pushed in north of it. On November 22nd several scattered regiments from the reserves of the *Second German Army* arrived in the line opposite *III Corps*. By November 23rd the *Arras Group* had six divisions including the *3rd Guard Infantry Division*, and from this time divisions, guns and aeroplanes continued to arrive till the *Arras Group* had 7 divisions, 500 guns and 7 air squadrons, and the *Caudry* and *Bussigny Groups* had 12 divisions with a corresponding

[1] Sir D. Haig's Despatches.

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number of other troops by November 30th. Apart from the arrival of reinforcements any delay gives time for good troops to pull themselves together, and experience proves that, in armies such as the British or the German, fresh troops arriving are little affected by the reverses which may have befallen their comrades. The action of the newly-arrived *107th Division* is very notable. They were seemingly pushed into the fight without very much plan, but the subordinate leaders were so imbued with self-confidence and initiative that they scattered themselves and occupied every bit of cover with machine-gun detachments, which at once brought any advance of infantry or cavalry not covered by tanks or a barrage to a standstill.

The other interesting fact is the manner in which the wearing off of the surprise affected our operations. The tanks were always able to make ground, though with ever increasing difficulty and losses. But the machine guns grew so numerous that the tanks could not keep down their fire, which became so intense that infantry could not live in it or keep up with the tanks. The operations therefore failed through the co-operation of the various arms being destroyed.

Co-operation of all arms.

All the success in this battle was won by the co-operation of the three arms, infantry, tanks and artillery. In no case were tanks able to accomplish anything lasting by themselves. All the commanders of brigades of the Tank Corps point out the great value of having infantry with them who have been trained with tanks. It has not been possible to describe the various actions in sufficient detail to bring out the great amount of fighting done by the infantry in conjunction with the tanks in overcoming strong points with their platoon weapons. But this is very apparent in all reports on the battle by divisions.[1] If the infantry is not closely accompanying the tanks the enemy take cover and hide themselves, and tanks with their defective vision are unable to see them. Nor can they by themselves deal with large numbers of concealed machine guns. In short they cannot "mop up." Without the accompanying infantry few of the 9,000 prisoners taken in the battle would ever have reached our cages.

[1] Further Notes on Operations, 62nd Div.

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Then again cases may occur in which the infantry can silence hostile anti-tank weapons, which the tanks themselves cannot get at, as occurred at Flesquieres. Any class of armoured vehicle showing over the ridge there would have been so conspicuous that it would at once have been destroyed by the guns. The guns, therefore, could only be put out of action by men on foot creeping forward and dealing with the detachments by small arm fire.

Finally a force of infantry is required to hold any ground captured. The strength of this depends on the size of the force likely to counter-attack. From these considerations it is apparent that every armoured force which is to achieve decisive results must be accompanied and followed by infantry. The accompanying infantry must be highly trained to move quickly and work with tanks. On the other hand the quality of the force destined to occupy the position need not necessarily be quite so high, and its numbers compared with the past can be reduced by the extensive use of machine guns. Nowadays the question of infantry accompanying tanks is further complicated by the increasing speed of the latter as they improve. Tanks to carry infantry (Mark V*, an adaptation of the ordinary Mark V) were tried in 1918 and were a failure.[1] Possibly some better scheme may be devised in future, but it is a question whether it is worth while going on increasing the engine power of tanks to be used in the assault, and whether it would not be better to have a larger number of slower and therefore cheaper machines to work with infantry.

As regards the general problem of mechanisation these remarks apply only to the movement of infantry on the actual battlefield, and do not apply in any way to the method by which they are brought up to it. Again in considering the place which armoured vehicles are to take on the battlefield in future, it must be remembered that the first German instructions for dealing with tanks, so far as is known, were issued in March 1918. The Germans at Cambrai had no special apparatus and no concerted measures to deal with tank attacks, and in future battles such measures may be expected. It is quite possible that in their attacks on concealed anti-tank weapons, tanks unaided may be no better off than warships opposed to forts.

[1] "The Tank in Action." Capt. D. G. Browne, M.C. (Blackwood), p. 334.

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The artillery took its full share in assisting the other arms, by putting down smoke screens and ordinary barrages and by counter battery work. There is nothing to show that its value will decrease. Aeroplanes took their share also, to a minor extent, in the actual fighting. They will undoubtedly be of value in future in spotting anti-tank weapons and bringing gun fire on to them. But their fire effect against small concealed targets will have to be greatly improved if they are to be of much direct use in covering the advance of tanks.

The future.

Looking to the future it is difficult to say what will happen if war on land ever takes the form of armoured forces cruising about and fighting fleet actions. But so long as other nations put their faith in great armies, and so long as no new weapons are invented, the lessons of the Battle of Cambrai must command respect. One of these is that a great army in position will smother a comparatively small armoured force. Completely armoured, swiftly moving forces will have great uses for special purposes. But for the heavy slogging of decisive battles nothing has been found to take the place of the co-operation of all arms, to which tanks and aeroplanes have now been definitely added. Our efforts must be so directed that our tactics and training will ensure the best combined use of these new arms, and our organisation so planned that there will be a proper proportion of them available on all occasions. The Battle of Cambrai and the great battles of the autumn of 1918 have shown beyond dispute the value of the tank in restoring mobility to the modern battlefield and in saving casualties. It is to be hoped that in years to come it will be as rare for an attack to go in without tanks as it is for one now to go in without artillery support.

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THE STORY OF "R.A., SHAFORCE."

By Colonel J. H. M. Cornwall, C.B.E., D.S.O., M.C., *p.s.c.*, R.A.

About the middle of January, 1927, military circles at Aldershot and elsewhere were mildly excited by the prospect, or at least the rumours of war. Quite unfair, of course, for such international disturbances to break out in the middle of the furlough season. July, August, or even October, have throughout history been considered legitimate months for sabre rattling, but January has, ever since the days of Cæsar, been regarded as a "close season" for military preparations. However, on this occasion a Conservative Government broke away from the long-established tradition, and mid-January saw a sort of "boot-and-saddle" frenzy breaking out at certain Gunner stations at home. This involved the recall of some officers from Switzerland and others from their hunting-leave, while in the general scurry of ordering new field-boots and Wolseley helmets, pathetic attempts were made to dispose of unwanted horses and motor-cars.

The notice given to units and individuals varied from seven to fourteen days, and by February 12th the 4th Light Brigade, R.A. (then designated "Pack Brigade") from Norwich, and the 1st (Army) Field Brigade, R.A. (less two batteries) from Deepcut had embarked for the Far East. The voyage was made in the hired transports "Herminius," "Bellerophon," and "Calchas," chartered for the purpose. These vessels were designed for freight transport, and the lack of deck-space, owing to the number of hatches, winches and derricks, made it difficult to provide the troops with adequate recreation. The 4th Light Brigade, which was the first R.A. unit to embark, had a rough time in the Bay and the Mediterranean. All three ships had a trying non-stop run of sixteen days across the Indian Ocean from Suez to Singapore. Hongkong was reached on the 34th day after leaving England, and both R.A. Brigades

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were disembarked at Kowloon, on the mainland, where they were accommodated in temporary billets and camps.

It may now be as well to take a glance at the situation in the Far East which occasioned the hasty despatch of British troops at the beginning of 1927. Ever since the fall of the Manchu Empire in 1911, China, saddled with an unsuitable Republican Constitution on Western lines, had broken up into a welter of more or less independent provinces, each at the mercy of some local "Tuchun," or military leader, whose sole object was to enrich himself by exploiting the revenues of as large an area as possible. Owing to these conflicting interests, coupled with the lack of either collective patriotism or military capacity in the Chinese nature, the power of the Central Government in Peking gradually declined, until finally it collapsed completely in the aftermath of the Great War.

In the resulting political confusion anti-foreign outbreaks, instigated by the *Kuomintang*, or Nationalist Party, with the active support of Soviet Russia, became more frequent, until the lives of foreigners in the interior of China, and even in the Treaty Ports, became unsafe. The outbreaks at Wanhsien and Hankow, up the Yangtsze River in September and November 1926, brought matters to a head, and it became increasingly manifest that the objective of the *Kuomintang* was the expulsion of foreigners from the Treaty Ports, and more especially from Shanghai, the great and wealthy international trading emporium of Central China, situated near the mouth of the Yangtsze.

Nearly half of the foreign trade of China passes through Shanghai, and the majority of it is carried on by British firms. The amount of British capital invested in China (exclusive of Hongkong) amounts to some £150,000,000. The next most interested powers are Japan, with less than half, and the United States of America with less than one tenth of the above capital involved. A very large proportion of this British capital is invested in Shanghai or in the Yangtsze trade, to which the port of Shanghai serves as a focus. It was therefore not surprising that the British Government felt itself obliged to despatch a strong force for the defence of the International Settlement, although the British Crown possessed neither territory nor sovereign rights in the area. This was the *raison d'être* of the Shanghai Defence

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Force—abbreviated telegraphically to the more convenient "Shaforce."

Shanghai, like ancient Gaul, may be divided politically into three parts:—

(a) The International Settlement.

(b) The French Concession.

(c) The Chinese City and Suburbs.

The International Settlement comprises the most important business and industrial portion of the city, and is administered by a very efficient municipal council, consisting of British, American and Japanese members, elected by the ratepayers. The International Settlement, for the specific defence of which the British forces were despatched, is a considerable city in itself—comprising some 30,000 foreigners and about 850,000 Chinese. The total population of Shanghai, including the French Concession and the Chinese City, amounts to some two millions.

From the military point of view it would be hard to find a place more unsuitable for defence than this settlement, consisting as it does of a narrow strip of densely populated city, 10 miles long and averaging one mile in width. The perimeter of this defensive area amounted to 40,000 yards, or 22½ miles, about 10,000 yards of which consisted of water frontage along the left bank of the Huang-pu River—resembling the Thames at London—with a width of four to five hundred yards; tactical and other considerations demanded the occupation of several wharves and factories on the further bank (Putung). There are no bridges across the Huang-pu, and ocean-going steamers can anchor opposite the Bund. Another factor which hampered the defensive organisation was the fact that the whole of Shanghai is built on one dead flat level, and there is not a rise of six feet anywhere in the whole settlement. Thus the ground presents no tactical feature, no key position of any kind. The only O.P's available are those afforded by water towers, the outlook towers of the fire-stations, and certain other high buildings such as factories or blocks of flats. Gun-positions are still more difficult to find. The only open space of any size is the fine recreation ground belonging to the Race Club, situated at the junction of the Nanking and Bubbling Well Roads,

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a mile from the Bund. This space, however, was earmarked as an aerodrome, and the gun positions were confined to a few small parks and vacant building plots, surrounded generally by elevated buildings and telegraph wires.

The first defensive measure was to enclose the whole of the International Settlement (except the river front) with a wire obstacle, the French taking similar precautions in their concession adjacent on the south. The most serious trouble was to be expected in the northern sector of the settlement, the industrial Hongkew quarter situated between the North Railway Station and the Soochow Creek, which lies contiguous with the still meaner Chinese suburbs of Chapei and Paoshan. It was here in fact that the only clashes took place, the 5th Armoured Car Company, the Durham Light Infantry, and the 4/1st Punjabis, all being engaged here in street fighting and suffering some casualties when the defeated Northerners tried to take refuge in the settlement during March.

The first Royal Artillery units to arrive for the defence of Shanghai were the 12th Pack Battery and the 16th Medium Battery, which accompanied the 20th (Jhansi) Infantry Brigade from India. Owing to the difficulty of finding suitable billets, these two batteries were quartered at opposite ends of the settlement, 13,000 yards apart, so that there was little chance either of single command or concerted action. Towards the end of March, however, the C.R.A. (Colonel-Comdt. E. F. Shewell, C.M.G., D.S.O.) arrived with a small staff, and proceeded to evolve order out of the somewhat chaotic conditions then existing. The first thing to be done was to concentrate the whole of the available guns at Shanghai—for purely administrative reasons the 1st Field Brigade and 4th Pack Brigade had been disembarked at Hongkong. This operation sounds easy enough, for Hongkong is only three days' steaming from Shanghai, and transports were available, but the "Q" staff absolutely vetoed the introduction into the congested Shanghai area of three more batteries with pack animals. A compromise was rapidly decided on. The pack brigade, less its animals, was transferred to Shanghai; on arrival, the 12th Pack Battery (which was on the Indian Establishment) handed over sufficient animals, saddlery and Indian drivers to mobilise one battery (the 15th) on a draught basis, while the other

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two batteries and the Brigade H.Q. were mechanised by hiring one Ford car and three Ford vans, and borrowing eight 3-ton lorries from the 16th (Tractor-Drawn) Medium Battery. Thus by a rapid improvisation the whole of the available guns were concentrated at Shanghai without increasing the forage strength of the force by a single mule. Each battery left its captain and drivers behind at Hongkong to look after its animals. Ramps were improvised by means of which the 3·7″ howitzers could be rapidly man-handled into and out of the lorries. This improvised mechanisation proved a great success, and afforded undoubtedly the most efficient and economical method of moving guns rapidly from place to place in a crowded city.

By the 6th April the artillery concentration was complete, and the units under the orders of the C.R.A. Shaforce were as follows :—

1st Field Bde., R.A.		
(Lt.Col. M. Muirhead-Murray, D.S.O.)	11th Field Bty., R.A.	18 pr. mechanised.
	80th ,, ,, ,,	4·5″ how. ,,
4th Pack Bde., R.A.		
(Lt.-Col. H. F. L. Grant, D.S.O.)	15th Pack Bty., R.A.	3·7″ how. mule-draught.
	20th ,, ,, ,,	,, mechanised.
	21st ,, ,, ,,	,, ,,
Unbrigaded.	12th Pack Bty., R.A.	3·7″ how. mule-draught.
	16th Med. Bty., R.A.	6″ how. mechanised.
Shanghai Volunteer Corps.		
	"A" Bty.	4·5″ how. horse-draught.
	"B" Bty.	2·75″ gun mechanised.

All batteries were on a 4-gun establishment.

A few words of description are called for as regards the two last units in the list. The Shanghai Volunteer Corps, an efficient body of some 2,000 foreign residents maintained by the Municipal Council, comprises two 4-gun batteries which were placed under the orders of the C.R.A. Shaforce during the emergency. The 4·5″ howitzers are drawn by sturdy little China ponies, and this battery is an all-British unit. The 2·75″ gun battery is commanded by an ex-gunner Canadian officer, Lieut.-Col. Cosgrave, the remaining officers and other ranks being Scandinavian, Dutch and Swiss, in separate sub-sections. The whole was commanded by Brig.-Genl. E. B. Macnaghten, C.M.G., D.S.O., late R.A.

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During the first weeks of April the small staff of H.Q. R.A. was kept very busy. Not only had billets to be found and fixed up for all the R.A. units in a densely populated city already overcrowded with troops, but a host of other pressing necessities called for immediate action. An artillery plan had to be evolved in conformity with the general defence scheme, battery positions and O.P's had to be reconnoitred and selected, telephonic and visual communications organised, and arrangements made for co-operation and liaison with the infantry, the Royal Navy and the Royal Air Force. Decisions had also to be taken regarding the formation of a reserve of gun ammunition and the system of ammunition supply.

According to the defence scheme the International Settlement was divided into three defensive sectors, each allotted to one infantry brigade. The enormous extent of the defensive perimeter has already been mentioned, and the problem was how to dispose the few available batteries to ensure their most effective and economical employment. In the case of the two most vulnerable sectors one 3·7″ how. battery organised for mule draught was placed under the orders of the Infantry Brigade Commander, while the light gun battery of the Shanghai Volunteer Corps was retained as a reserve in the hands of the C.R.A., to be rushed up in lorries to support any threatened point. The remaining six batteries were organised in two groups, each commanded by a Lieut.-Colonel, R.A., one group covering the right and centre sectors, the other supporting the left or western sector, the most extended of the three. In addition, alternative forward gun positions had to be sited to deal with the *Kuominchun* armoured train which was active on the Shanghai—Nanking railway skirting the northern boundary of the settlement.

From the gunner's point of view our principal difficulty was one of observation. To begin with, the whole of the surrounding country was as flat as a billiard table, so that every O.P. near the perimeter of the settlement assumed great tactical significance. Even from the best of these O.P's the view was extremely limited, but in effect we should have been entirely dependent on them for any accurate fire, for the following reasons. Firstly, predicted shooting was not practical, as no trigonometrical points were known, the co-ordinates of which could be referred to the grid on our maps,

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and no meteor service existed. Secondly, very few aircraft were available for artillery co-operation, and at the outset the pilots were practically untrained in spotting on land. It is true that pilots trained in army co-operation work were available on board H.M.S. "Argus," but for some inscrutable reason these were not brought ashore. The arrival of an army co-operation squadron, R.A.F., a month or so later made a great improvement in this respect.

A chain of some twenty O.P's was therefore organised along the defensive perimeter, each linked up by telephone with the nearest battery positions and with the headquarters of one or other of the artillery groups. In each group sector three of the best O.P's were permanently manned by an officer's party during the hours of daylight, and in each sector sections of guns were in action day and night, laid out on S.O.S. lines or on selected targets.

These early days in Shanghai were strenuous ones, but they were not without a few comic touches. In order to avoid shedding innocent blood during disturbances each battery was provided with a "riot flag," a white banner on which was inscribed in large Chinese characters:—"Disperse immediately or we open fire!" On one occasion a detached section was found in action with this banner conspicuously displayed between the guns, and a large gang of municipal coolies working peacefully just in front of the muzzles. Apparently the section commander was ignorant of the significance of the flag, but as it was hoisted upside down and the Chinese coolies were quite illiterate, no alarm was caused.

In a congested city like Shanghai, where the price of an acre of land on the Bund is five times the value of land in the City of London, the problem of billets and recreation grounds soon became acute. By the time that the gunners landed, there were already thirteen battalions, an armoured car company, a company of Sappers & Miners, and a M.T. Company in Shanghai. Two batteries were accommodated in hastily constructed wooden huts, two others went under canvas, while the remaining three occupied "close billets" in two of the public schools put at our disposal by the Municipal Council. These latter were the best housed, and were most sympathetically looked after by the kind-hearted Miss Gosse, the headmistress of the municipal schools, who proved a veritable fairy godmother to the gunners in Shanghai. Miss Gosse has since allied

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herself still more closely with the Regiment, being now Mrs. F. P. Hallifax.

Recreation grounds also proved a great difficulty at the outset, but this problem also was eventually solved in a satisfactory manner, although the great distance from billets to grounds was inconvenient. The race course, a fine open space of about 70 acres in the heart of the settlement, provided several football and hockey grounds, and a locally organised body, the British Forces Recreation Centre, contributed materially to the recreation of the troops by providing sports gear and in running canteens. Another local organisation, the British Women's Association, also did excellent work in catering for the entertainment of the troops by getting up dances and concerts. The officers were comparatively well off in this respect, as good facilities existed for polo, tennis and swimming besides the ordinary games.

By the end of April the presence in Shanghai of the strong British Defence Force had produced the desired tranquillising effect, the defences of the area were well organised and complete, and the danger of the settlement being rushed was to all intents and purposes removed. The emergency precautions were therefore gradually relaxed and the batteries settled down to more or less normal training conditions. At the same time there was still a possibility of active operations, and plans had to be worked out for participation in such enterprises as the re-taking of Hankow and the occupation of the Wusung Forts at the mouth of the Huang-pu River. These eventualities, however, did not actually materialise.

Battery training was carried out under very difficult conditions. Beyond a few odd acres of vacant building plots there was literally no available training ground, and manœuvre was entirely confined to the settlement roads. For miles around Shanghai the alluvial plain is intensely cultivated, mainly under beans, cotton and vegetables. The cultivation is all done with the hoe, and the fields are small, mere garden plots, intersected by broad, deep and muddy irrigation canals. Manœuvre across country, even had it been permitted, would have been impossible to either the Holt tractors of the medium battery or the Burford-Kegresses of the field batteries, and the country would have proved almost equally impassable to

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the two pack batteries organised for wheel draught, carrying their ammunition in A.T. carts. The local bridges across the creeks are only wide enough for pack animals.

At the end of May the two remaining batteries of the 1st Field Brigade (52nd Bengal Rocket Troop and 98th) arrived from England, and to make room for them the whole of the 4th Light Brigade was transferred to Hongkong where it was grouped with the newly arrived 15th Infantry Brigade and brought directly under the orders of the War Office. The 4th Light Brigade actually sailed for Hongkong on the 4th June and from that date ceased to belong to Shaforce.

On the 11th June a very successful R.A. dinner was held at the Shanghai Club, 75 past and present members of the Regiment sitting down to dinner. The proceedings terminated in cheery spirit at a late hour, when a distinguished Admiral, the guest of the evening, was escorted in triumph to his barge.

By the end of June battery training was well advanced, but the local conditions did not permit of a practice camp being organised. On 1st July a tactical exercise with troops was held for all R.A. units, which proved instructive as regards the handling of mechanised artillery in mobile warfare. In the third week of July the C.R.A. carried out the annual inspection of all units.

During July the military situation in Central China continued to improve and it was decided to reduce the cost of the Shanghai Defence Force by withdrawing the whole of the Indian contingent, including the 12th Light and 16th Medium Batteries. These batteries embarked for Calcutta on the 29th July, and as the state of emergency no longer existed, and the Shanghai Volunteer Corps was no longer mobilised, R.A. Shaforce found itself reduced to the 1st Field Brigade, R.A. Orders were in consequence issued by the War Office for the disbandment of R.A. Headquarters. This was gradually effected, and the C.R.A. eventually returned to England in the middle of October.

The hot weather during July and August proved very trying to the troops, for although the shade temperature rarely exceeded 100°, the humidity was very high and the heat in consequence correspondingly exhausting. Prickly heat was a common and most irritating complaint, and much suffering was caused by abscesses

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in the ear; a few cases of pneumonia and dysentery also occurred. During this period the average number of men in hospital rose from about 5 per cent. to well over 12 per cent. However, the reduction in the size of the force permitted an improvement in the housing of the troops; better and cooler huts were built, fans were installed and recreational facilities were increased. Above all, leave parties were sent for a fortnight at a time in transports to Wei-Hai-Wei, where a summer camp and convalescent station were organised in a drier and healthier climate with ample facilities for recreation and sea-bathing.

Even the dog-days did not prevent a final flutter of military activity. On the 16th August one of our aeroplanes when returning from a reconnaissance was forced to make an involuntary landing on the Kiangwan race course, a few miles north of the settlement. The engine and fuselage were promptly retrieved by a break-down party sent out by the R.A.F., but the wings were detained by a guard of Chinese troops under orders from the Nanking Government. In consequence of this a state of emergency was declared for the Shanghai Defence Force, 50 yards of railway track were taken up on the Shanghai—Hangchow railway, and two 18 prs. of the 98th Field Battery were placed in action at Jessfield Station in readiness to engage the Nationalist armoured train. Consequent on these firm measures the aeroplane wings were surrendered, the Chinese politicians "saving their face" by pretending that the wings had been handed over by one of their military commanders contrary to the instructions of the Civil Government!

The advent of the cool weather in October and November brought about a welcome improvement in the health of the troops. An increasing number of recreation grounds became available, and batteries were able to play football, hockey or basket-ball practically every day of the week. Many officers took advantage of the privilege of a month's local leave to visit Japan, Korea, Peking, etc. A few managed to get a little shooting, while excellent amusement was obtained by riding China ponies with the drag-hounds or in the Paper Hunt. Good exercise could also be obtained from a run with the beagles on Sunday afternoons.

As the situation in Shanghai became more settled, the presence even of one artillery brigade appeared less necessary, especially as

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that unit was due to proceed to India in the normal course of reliefs. Accordingly the 1st Field Brigade embarked on 7th January 1928 for Bombay, and a few days later the 4th Light Brigade left Hongkong for England. R.A. Shaforce thus came to an end within a year of its formation, but the effect of its presence in Shanghai had fully justified its despatch to the Far East. Its members have carried away with them the memory of new friendships and fresh experiences, and will for long remember their pleasant days in Shanghai.

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THE BENEFIT OF THE DOUBT.

By Brig.-Genl. Cosmo Stewart., c.b., c.m.g., d.s.o.

THERE may still hang on the walls of the Royal Artillery Mess at Meerut an ibex head, which recalls to my mind vivid impressions both pleasant and unpleasant, as the result of my maiden effort in pursuit of that great animal. When presented to the Mess, it was a noteworthy trophy, when good ibex heads were few and far between; if it is there now it is still probably one of the best, however many others may have been added since.

I had spent one of the happiest years of my life as a very young officer at Meerut, fortunate in the society of as fine and as pleasant a lot of brother officers as even the Royal Artillery could produce, and from whom I, as the most insignificant and inexperienced member, received many and notable kindnesses. I left the station and my battery with great regret, and when I went up to Gilgit two years afterwards in 1893, it became one of my ambitions to secure some sporting trophy, which might worthily be presented to what was then I think the largest and most representative artillery mess in India, and of which I retained so many pleasant recollections.

The Gilgit Agency was at that time *par excellence* the best markhor and ibex shooting country attainable from India and almost untouched. There was no great made road into Kashmir before 1890, and none beyond it towards Astor. A number of keen sportsmen, including several gunners, had penetrated deep into the mountains of the Himalayas in quest of these animals, but such sportsmen had been comparatively few; good heads were therefore greatly valued. To reach the more remote shooting grounds fairly long leave and elaborate arrangements were necessary, and the sportsman had to spend many weary days marching over execrable roads and tracks.

If one ranged far beyond the Valley of Kashmir, the dates the passes opened and closed limited the season which could be put in on the ground, and this season was not the most favourable

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for securing the best heads. Beyond Astor, Ramghat, 50 miles short of Gilgit, where the Astor river flows into the Indus, formed the extreme limit accessible for shooting, and was a centre from which to enter several famous nullahs; but the Tragbal (11,500 feet) and the Burzil (13,500 feet) Passes, (the latter close on 20 miles long and not open for animals till the 20th of June), were serious obstacles. The waterless track over the high Hattu Pir down into the Indus valley was of evil repute, and the skeletons by the way testified to the hardships inflicted on the inhabitants in the form of compulsory coolie transport in carrying up supplies, etc., for the troops at Gilgit. Below Ramghat in the Indus valley was a tribal No Man's Land, while in the opposite direction the bad gorges and high rope bridges over the river limited access. Thus transport became a difficulty, and it was not easy to obtain good shikharis, who knew the grounds.

After the epic Hunza-Nagar Expedition of 1891, the Government of India took a more direct interest in affairs in the Gilgit Agency, and the number of British officers lent to the Kashmir State for duty with the newly raised Imperial Service Troops was greatly augmented. The Astor road was closed to sportsmen, and it followed that those officers attached to the Agency, who were sufficiently keen and energetic, found themselves in the happiest of happy hunting grounds.

Such was my unique opportunity. I left Rawal Pindi at short notice on the 15th of September, 1893, with a minimum of kit, the only luxury being eighteen bottles of whiskey, which strange to say, arrived safely (and of which nine still remained and were given away at the end of my three years !). I knew nothing of hill shooting, and brought no rifle or even shelter tent. But from the tales I heard on arrival from others, and the magnificent heads I saw, I soon became consumed with the desire to emulate their performances. I secured cheap from an officer returning to India an old and, as it proved, inaccurate double barrelled 500 Express; but it was months before I could obtain the permanent services of a good shikhari.

There are few forms of sport which to my mind come up to that of hunting wild goats and sheep in their rocky fastnesses in the great mountains, and no big game shooting which can rival it.

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The Gilgit country was particularly difficult, entailing constant rock climbing, for which grass shoes are almost essential and one's ordinary footwear worse than useless. Markhor and ibex frequent only the more inaccessible ground about and above the snow line, and days may often be spent in observation of a herd before they offer an opportunity to approach within shooting distance; the sportsman is always out to secure the finest head in the herd, and old bucks are especially wily. The hunter must be sound in wind and limb, sure footed and possess a good head for heights, and be prepared to endure considerable hardship from exposure day and night up at snow levels, with only bare necessities of food and blankets. On the other hand, nothing can exceed the sense of exhilaration derived from the pure mountain air and the wonderful scenery; while the greater the test of nerve and endurance the greater the value of any good trophy brought to bag.

I had my first experience two months after arrival, spending ten days Christmas leave up in the snow after markhor in the greatest discomfort, without hot food and sleeping under shelter of a rock where a small fire could only be lit with caution. I learnt a little what bad ground meant, and though I secured two fair heads of forty inches, I failed to get the big one I was after. I honestly admit that first attempt was more of a nightmare than anything else, and I would repeatedly wake up at night dreaming I was slipping or falling over some impossible precipice.

In February, 1894, I found myself in an old Dogra fort at Nomal, twenty miles the other side of Gilgit, which formed the winter quarters for the mountain battery, and which in past days had served to block the exit from a long formidable defile on the track from Hunza-Nagar and the Pamirs. The considerable Naltar Nullah joined the main valley just above the fort, and a great precipitous spur from a mountain 20,000 feet high descended abruptly between the two. I had been told Naltar Nullah was famous for its ibex, but these animals do not come down low like markhor in winter with the snow, and April was said to be the first month they could be shot, when the snow begins to melt on the grass mergs at and above 10,000 feet.

There was no other British officer at Nomal, and I had failed so far to secure a shikhari. I had mounted on to the roof of the

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little tower one bleak overcast morning while waiting for the battery to parade outside the fort, and as was my usual custom spent half an hour with binoculars and a battery telescope, scanning the heights around on the off chance of spotting game, the snow then lying about fifteen hundred feet above the valley.

The art of spying the side of a mountain for game is not one easily come by. The glasses and telescope must be worked systematically in order to miss out no ground; the likely places in which to find animals at different times of the day have to be appreciated instinctively; and, not least, the searcher must be gifted with good eyesight. The last was my only qualification. Even after much practice, I could count on the fingers of my hands the numbers of times I ever spotted markhor or ibex on my own, and I always found that a native shikhari, with his vision unspoiled by reading, etc., was far superior with his naked eye to the Englishman however well equipped with glasses.

But on this occasion fortune befriended me. As I gazed up through the telescope far away above the snow line, where there was not really likely to be anything, I suddenly saw a speck move across the snow. I could scarcely believe I had spotted game, but it could be nothing else, and closer inspection confirmed the fact. I soon made out a number of animals, but what they were, or whether there was any shootable head, was not discernable at that distance. I had never seen an ibex, and did not expect to, so I took it for granted they must be markhor.

Going on parade I asked the Commandant to send a gunner down to the village to try and get hold of someone who knew the ground to accompany me and help me in a stalk. On my return, I found quite an intelligent youth, who could talk a little Hindustani; he said he knew nothing of a shikhari's work, but did know the ground. I made a hasty meal and changed into shooting kit; having no grass shoes I put on "pubboos," loose socks of undressed ibex skin, which is very tough, lashed tightly round under the instep with raw hide thongs, which give a good grip, but are most uncomfortable.

The telescope had been left scotched up on the wall of the fort, directed on the spot where I had last seen the animals. They were still there, but my guide could make nothing of it; I do not

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suppose he had ever seen a telescope before, and I was not sure he did not take me for rather a lunatic. However, I managed to describe the spot we were to make for, and we started off, he carrying the rifle.

The going for the first thousand feet or so was easy enough, even to my unapt feet, till we got into rocky ground and the first snow. We were now under cover of the hill above us, and I had to trust entirely to the guide. It was no use attempting to go straight up, as the wind in the middle of the day blew from below and would carry our scent; in any case the ground was impossible. So we made a wide detour to our right round the shoulder of the spur, and my companion soon pointed to a projecting bit of ground another thousand feet up as our first objective.

Climbing now became a different thing; the ground was bad for anyone unskilled, and great care is always necessary in snow. My guide was almost in despair at my clumsy efforts, while the sweat streamed off me, despite the cold. But we progressed slowly and reached our point, where we made a short halt under cover while I regained my wind; I got busy with the telescope and managed to locate again an animal in motion, still far above us to the left. First I found one, then another, until quite a number had been spotted, some moving about and others lying down. They now looked considerably larger, and my disappointment was great when I could find no markhor head with the unmistakable corkscrew horns; I noticed some had what seemed small horns, curling back, but I took them to be female markhor.

"Sub madines! (all females!)" I said rather dejectedly, after having as I thought searched all the ground within view, and left the telescope scotched up on a rock, directed on them. The coolie then went, and lying down applied his eye to it. This time he managed to see, and rising up said: "Khel, Sahib!" which I knew meant ibex.

All my keenness returned at once. I had never seen an ibex, and looking again, noticed that the horns were too long for female markhor, and that it was only certain animals that had them. My guide now took quite a different interest; he had seen game for himself, and with a happy trust in the excellence of the Sahib's marksmanship, at once began to look forward to obtaining as much

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meat as he could gorge for several days. I promised him a liberal reward if he got me within fair shot of a good head, and he became as keen as I was myself.

We discussed the way we would have to go, which lay further round to our right, and set off again. Progress was necessarily slow and painful, but while it was real hard work for me, my companion made little of it. He could not save me much, as an experienced shikhari would have done, and I soon found I could not follow blindly in his footsteps, as being considerably heavier, foothold good enough for him would not always carry me. Neither had I yet learnt that it is safer to walk erect on steep slopes, than to lean inwards and use one's hands, as is the natural inclination. For by keeping upright the weight acts perpendicularly through the feet, the better angle giving a better grip, and lessens the chances of the feet slipping out; this is one of the things I found it most difficult to grasp as a novice. My head was none too good for heights; I hated it all the time, and had carefully to avoid looking down. But the guide selected our path well, and I was able to carry on.

In one place we came to a long steep uniform slope, formed underneath by debris fallen from the cliffs above (known locally as a "shoot," from the liability when crossing such a place at ordinary times to be "rocked" from above by stones of all sizes, which, loosened by changing temperatures, descend with great speed and force). This slope was now deep in snow, over a hundred yards across, and stretched away up above us for well over five hundred feet; it terminated two hundred feet below us in a drop into the void. The crust of the snow was slightly frozen, but was not hard enough to support our weight; without thinking we started to go straight over it, the guide breaking track in front, and I following close behind in his footsteps.

We had not proceeded more than thirty yards, when a very gentle thud behind caused me to look round, and I saw with dismay that the snow for fifty feet or more above our track had slipped down over it, completely obliterating it, and leaving a rift above, shaped like a great inverted "V."

I at once realised the danger of the weight of displaced snow from above starting the mass of it below into motion, thus causing

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an avalanche, the size and force of which would be liable to increase the further we went, and which, if started, whatever its magnitude, would carry us away like peas. Such avalanches are quite common in these mountains later in the year, when the sun's rays begin to gain in strength.

Luckily I remember to have listened to Major A. A. Barrett of the 5th Goorkhas (the late Field-Marshal Sir A. A. Barrett), describing how Swiss guides negotiated such places in the Alps. They had warned him of the danger of any attempt to cross straight over such slopes, as the great weight of snow above is often held up from slipping only by the crust, and when this is weakened by the making of a track across it, or is thawed through sufficiently by the sun, the whole mass of snow is apt to descend in an avalanche. They said the only safe method of getting over was to ascend by short zig-zags up the edge of the slope on one side, cross over right at the top, and descend the other side in like manner.

My companion had also become alarmed, when he saw what had occurred. We retraced our steps with the utmost care, the snow which had slipped closing down again over our track. But we got back safely to the edge, and then toiled up laboriously to the top, crossed, and descended nearly the whole way again on the far side, on the Swiss principle. Had it not been for the fortunate chance by which I had overheard Major Barrett's conversation, our stalk might have ended very differently.

After considerable exertions we reached another spot, whence by creeping up to the edge of a rocky ridge, it was again possible to spy the ground where the ibex had been seen. We crawled in the snow very carefully up behind a rock; I let the guide have first look without glasses, judging we were now close enough for him to see with his eyes; a glance was enough for him, and he withdrew smiling, saying: "Beshak khel, Sahib, barra singhwallah! (Ibex, Sahib, and a big one!)" I crept up with the telescope; there right enough, still close on a thousand feet above us and well away to the left, were a fine herd standing and lying down on a minor spur, several of them bucks.

I knew nothing then about estimating the length of ibex horns from the curve, but I judged some of them must be shootable, i.e. forty inches or over, and it was possible there were others we

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could not see. The chase was now really exciting, and after we had again examined the ground for the best and most practicable line of advance and approach, we went on full of hope. I impressed forcibly on my companion that I only wanted to shoot at the best head, and repeated my promise of a good reward if he got me up for a fair shot.

That last thousand feet took us a good hour and a half. The snow got deeper and deeper and the ground no better; we had frequently to retrace our steps for short distances, and though in hard condition, I was getting done to the world, fingers without gloves or mittens and feet feeling like ice. But all went well, and at long last we found ourselves in the cover of a small nullah up at what we calculated was about the level of the herd. Here we rested to recover breath and for me to get feeling back into my hands. I again reminded my companion, fearful lest in his excitement he should endeavour to get me to take the first shot that presented itself, that the backshish only held good for a shot at the best head, and that for me to get a steady aim, he must lead me up to a position where I could obtain a rest for the rifle. I had still to realise how difficult it was to get this into the head of any but a good shikari, and one had often to shoot as best one could. We peered over the edge of our nullah. Projecting ground intervened, with another nasty looking nullah in between. There was no game in sight, except one alert female doing sentry, but she was looking straight down the khud and evidently had not discovered us. Owing to the depth of snow and the nature of the ground, it was useless to try making a further detour, so as to get above the herd, and there was nothing for it but to remain where we were, and wait on events. This we did reluctantly, as it was now nearly 4 p.m. and the days were not long; we dared not risk being benighted in the snow without blankets. We had come up a good 4,000 feet, and the considerable Hunza river looked like a mere thread of silver winding away far below us.

I took the rifle out of its waterproof canvas case, and passed the time practising snap aiming at marks all around, while the coolie remained in observation. He withdrew from his position after waiting half an hour, which seemed interminable, and whispered that the female had disappeared over the far edge, and that

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we had better make a dart for the ground she had been on, chancing whether there were any others of the herd below us in the nullah. I agreed, and we prepared to hustle over the top of the ridge into cover again; I loaded the rifle, putting it at "safety," but stupidly kept it out of its case, carrying it myself lest anything should appear. But we had hardly commenced to descend the forward slope, when up jumped another infernal female, and disappeared in front of us, giving the peculiar warning note of these animals.

There could be no doubt we had been spotted, and throwing all caution to the winds, I dashed ahead, rifle in hand, intent on reaching the next crest in time to get a shot. How I got over that bit of ground unassisted or without slipping badly, I do not know; but between jumping and scrambling and falling I got to near the top, and then fell in the snow, the rifle getting buried muzzle first. I had enough sense left to open the breach, extract the cartridges, and the bore being choked with snow, to blow down each barrel in turn, which luckily cleared them. Then out of breath, I reloaded, and with the coolie still some yards behind me, cautiously looked over the edge. All this was about the worst possible preparation for a steady shot!

At first there was nothing to be seen, and my disappointment was intense. The coolie then came up and nudged me forward. Another rocky spur came into view, running down and away from us, and there at the end of it to my great joy, were still a number of animals; some were just disappearing over the edge, others stood looking back in our direction preparatory to bolting, while one was still lying down, which even to my unaccustomed eyes, was obviously a magnificent head. He was about 150 yards away, looked coal black in the snow, with a pair of great horns which curled back till they seemed almost to touch his neck. I learnt afterwards that such horns may be counted on to measure forty-five inches.

There was nothing behind which to take cover, or on which to rest the rifle; the snow was above our knees on the wind swept ridge, and I had to take a snap shot. I scrambled forward a few yards till I could get a clear view over the sights, and dropped down to get a rest with my elbows on my knees, an excellent position provided one can get into it without giving one's presence away.

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This of course I did, but for a few seconds the big fellow remained motionless, regarding us. I hastily drew a bead at the indifferent target he presented, aiming low, and fired. He jumped instantly to his feet, and I felt I had missed. I gave at once a long low whistle, which I had often found efficacious in exciting the curiosity of animals when alarmed and causing them to pause before making off. Whether for this reason or not, he stood for a couple of seconds broadside on, offering a splendid shot, still looking back at us. It just gave me time to take a steady aim and fire again; but when the smoke had cleared away he had disappeared.

My guide, after the manner of coolies and indifferent shikharis, at once said: "Luggya, Sahib!" but all I knew was the ibex had not dropped to the heart shot, as I had hoped. Whether he had been hit or not could only be decided by getting to the spot where he had been standing, and looking for blood or hairs from his coat, (which are sometimes the only trace left at the actual place, even if the animal has been mortally wounded); but the ground rendered this impossible. Neither was there the least chance of getting to it by making a detour round above, even had daylight permitted of us making the attempt. There was nothing for it but to retrace our steps, and get the worst of the descent over before darkness came on, and, very disheartened, we turned to do so. Our only hope was, that if the weather was kind, we might perhaps find a way up the other side next day to look.

As we returned, my guide pointed to my marks in the snow, and remonstrated with me for the risk I had taken in going on ahead by myself without looking where I was going, and said I had been very foolish: "The Sahib must not do such things; if anything happened to him, it is I, who accompanied him, who would be held to account; it was God's mercy the Sahib did not slip and fall more than once." On a closer inspection, I was inclined to agree with him.

I got little satisfaction from questioning him on the way down. He did not seem to have anything very definite to say in support of his assertion that the ibex had been wounded; he maintained the animal had winced to the shot, but he certainly had not stumbled, and as the ground he had made away over fell at once steeply from us, I did not attach much importance to what he said.

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What sportsman who has hunted these mountain goats has not experienced the sudden revulsion from intense excitement and hope to the deepest dejection which follows on an unsuccessful shot? After perhaps days of toil and privation the longed-for opportunity arrives, only to be thrown away, with generally only oneself to blame! The shikhari and the coolie share the disappointment, for the reputation of the first suffers among his fellows, while all have to go hungry for meat. The long tedious descent under such circumstances must always be a dismal performance, till, tired out and cross, the little shooting camp is reached. Even then all the world looks grey; the hunter feels sure he has missed an altogether unique chance of securing a great trophy, which loses nothing in size by retrospection; and he feels almost inclined to vow he will never be such an ass as to try for another. But after a good hot meal, followed by a strong hot glass of whiskey and water and a pipe, hope begins to return. A sound sleep further restores expended energy, and with the next morning he turns out filled with the determination that next time at all events, he will not fail! Such is sport.

Low clouds, heavy falls of snow, and the nature of the ground all combined to prevent any search for that ibex for weeks. By then I had secured the services of a first-rate shikhari, Abdur Rahman, and we went for a trial trip after markhor up Naltar Nullah, the snow now lying a good deal higher on the hills.

We set out up the great spur on which I had got my shots, keeping along its flank on the Naltar side, in which direction the ibex had disappeared. We had been going some hours, when Abdur Rahman, who was several yards in front, stopped with an exclamation of astonishment. "See, Sahib," he said, "here lies the carcase of your ibex," pointing to an object fifty feet below us, "This is not ibex ground, and no ibex would have fallen here, even if pursued by a snow leopard."

We climbed down to the spot. "This is a great ibex, Sahib," said the shikhari, "Seldom have I seen one so great; the head is worth lifting for that reason alone." We measured the horns, which were 48 and 47½ inches. The animal had evidently lain there for some time, and we could not determine from an examination of the skin whether he had been shot, as the vultures

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had been at him. He lay well below the level of where I had fired, and far below any likely ground for ibex; this all tended to show he was the one I had shot at, as only a wounded animal, too weak to go up, would have fled on a downward course.

We sent the head back to Nomal. It proved to be the largest ibex got in the Agency during the three years I was up there, and as good a trophy as a markhor of 55 inches. I only once saw one I thought larger, also in Naltar Nullah, and missed him. I thought I might fairly lay claim to having shot the animal we had found, and wrote to the Mess Secretary at Meerut, explaining that I could not be certain of having done so, but would like to present the head to the mess, if they would care to have it. It was accepted, and arrived in due course. I received a letter of thanks, in which it was stated the horns were just eighteen inches longer than those of any other ibex in the mess at that time!

There are red letter days in the life of every sportsman, which, as the years roll by, are liable to become enveloped by fancy in a legendary halo, peculiar to the particular sport and the individual. The greatest days to me in big game shooting are those when some dangerous or wily animal has been brought to bag more or less by one's own skill, without the aid of a shikhari, and when the incident has been accompanied by some special element of danger or difficulty. If the trophy is in any way remarkable, so much the better.

Here all these elements had been present; and the satisfaction of recollection was only qualified, still very much qualified, by the lack of actual certainty that I had slain such a father of ibex at my first attempt and on my own.

But Time, kind in most things, has been kind in this; I now give myself the benefit of the doubt, and have grown to regard the day in truth as a red letter one.

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SAVING THE GUNS AT MAIWAND.

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not go to war intact with all its personnel highly trained. Officers will be taken for staff duties, picked N.C.O's will be promoted and may go elsewhere, while reservists, only half trained, will bring the battery to war strength. During the fighting, casualties are bound to occur and will be replaced from the reserve or from new recruits; trained personnel will be withdrawn to form the nucleus of new batteries. Again, it will not be possible to bring such new batteries to a high degree of efficiency in the limited time available

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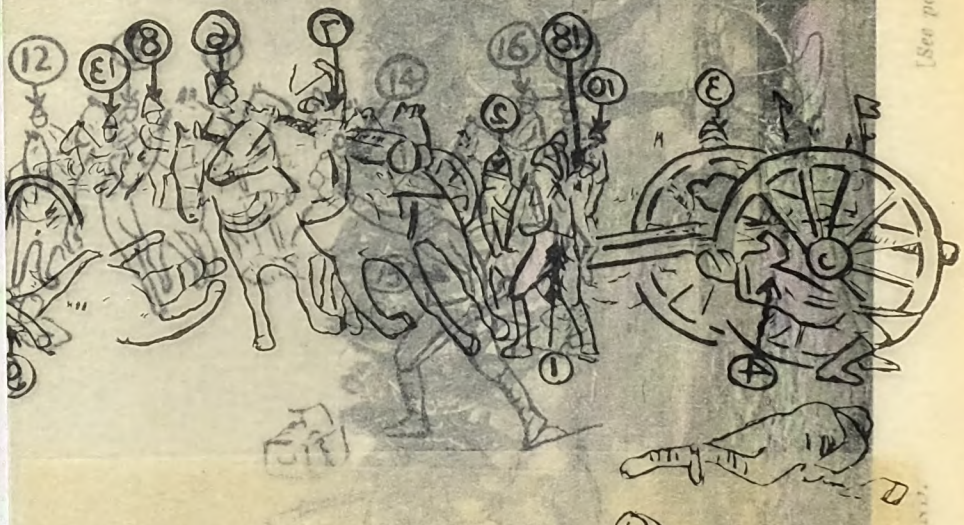
"SAVING THE GUNS AT MAIWAND"

Key Plate.



The print shows the saving of the guns Royal Horse Artillery at MAIWAND on July and was drawn by the artist from details given Lt. S.M.W. Foster D.C.M., and Sergt P. Mullane V.C.

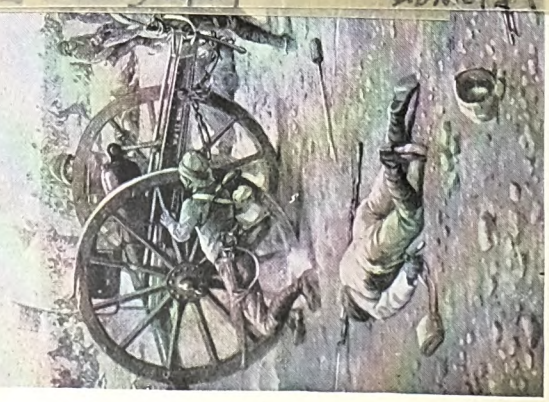
The names of the men who rescued the guns from Mr W.H. Williams (a survivor) who served in throughout the action are as follows:

E Battery 9 Brigade R.H.A. became the 3rd Field Bde

No1 Sgt H.J. Wood (killed) No1 No4 Subdivision No10 Sgt

2 Gnr G. Smith (") " " " Dr

Limbergunner " " " " Drivers



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"DUNCAN" SILVER MEDAL ESSAY, 1927-28.

Since aerial operations in the future will assume greater importance than was experienced in the last great war, discuss the advisability of rendering all, or the bulk of artillery units of the field army capable of dealing with air targets. What changes would be entailed by the adoption of such a policy in regard to :–

(a) Organisation.

(b) Training.

(c) Equipment, including ammunition of the Royal Artillery.

BY MAJOR R. G. CHERRY, M.C., R.A.

"PROSPICE."

THE Artillery of the Field Army has, in modern warfare, so many duties to carry out, that any proposal to complicate them must receive the most searching scrutiny before a decision can be reached as to whether such addition is technically and tactically sound and will therefore make for increased efficiency. Although it is laid down in the manuals that certain weapons are more suited than others for carrying out certain tasks, yet we find to-day that the light howitzer, the field howitzer, the medium howitzer, the field gun and the medium gun are all expected to deal successfully with a wide variety of tasks, which include covering fire, predicted shooting, shoots with air observation, smoke screening, fire on ordinary moving targets, and breaking up of tank attacks, all of which tasks demand different methods of application. Yet it must always be remembered that even a regular battery will not go to war intact with all its personnel highly trained. Officers will be taken for staff duties, picked N.C.O's will be promoted and may go elsewhere, while reservists, only half trained, will bring the battery to war strength. During the fighting, casualties are bound to occur and will be replaced from the reserve or from new recruits; trained personnel will be withdrawn to form the nucleus of new batteries. Again, it will not be possible to bring such new batteries to a high degree of efficiency in the limited time available

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for training before they are called upon to take the field. Such considerations are bound to influence any proposal to add to the fighting duties of the Artillery of the Field Army.

It will now be necessary to examine from various points of view the question of how and to what extent all or any of this artillery can be utilised to counter the ever increasing activities of aircraft in the battle area.

(A). *The roles of Aircraft in the Field.*

These may be conveniently grouped according to the measures that will be taken to counter their activities, considering the equipment that we have now available.

(i) Long distance reconnaissance, photography and bombing. Protection against machines engaged on these duties devolves upon the anti-aircraft batteries in the back areas, as these machines may be expected to cross over at heights beyond the effective range of mobile anti-aircraft artillery.

(ii) Short distance reconnaissance, photography and bombing, artillery observation, fighting patrols.
Protection against these devolves upon the anti-aircraft batteries in the forward area.

(iii) Low flying machines engaged in the attack of troops and transport with bombs or machine guns, or carrying out intimate reconnaissance of important dispositions.

These machines are not, as will be shown in detail later, such a suitable target for anti-aircraft artillery. Protection against them will devolve mainly on machine guns or light automatics of the units concerned and on the Lewis gun sections of A.A. batteries. The advent of mechanisation will undoubtedly lead to increased air activity, especially at low and very low heights. Aeroplanes will have to fly low in order to find out what is going on. The power of cross-country movement will reduce the length of road columns, and the strategical reserve, whose location is so important, may well be a collection of vehicles grouped around woods instead of a mass of troops, horses, cookers and transport, so easy to observe.

On the other hand, concentrations of tanks prior to an attack, parks of cross-country vehicles, petrol convoys and the like are very vulnerable to low bombing; we may also expect to see aeroplanes

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flying low co-operating closely with tank attacks. Especially will this low flying be popular at the outset of a campaign, when the morale of pilots will be high, and they will not have learnt caution from heavy casualties. It is therefore important to employ all practical means to ensure that casualties among such aircraft will be high at the outset.

(B). *The function of A.A. armament in the Field.*

It is clearly laid down that the attack of hostile aircraft by fire from the ground is subsidiary to the attack of them and their aerodromes from the air. It is in fact recognised both by the Army and the R.A.F., that the most efficacious methods of preventing hostile machines from interfering with operations is to attack and defeat them by a bold and skilful use of our own aircraft. As, however, our own machines cannot be ubiquitous, and as the greater part of them will be employed in offensive work in advance of our front, it is necessary to have efficient resources on the ground to protect the army. It is, moreover, a corollary that the more efficient is the anti-aircraft organisation, the more complete will be the release of our own machines for their offensive in the air.

The functions of anti-aircraft weapons are also clearly defined and should be briefly stated here in order that we may start from sound premises in putting forward suggestions for augmenting their power. These functions are :—

(i) To harry enemy aircraft, forcing them to fly at such heights and on such irregular courses that they cannot efficiently carry out their duties.
(ii) To destroy enemy aircraft.
(iii) To break up their formations and thus render them more open to attack by our own machines.
(iv) To assist and protect our own machines, and indicate the presence of hostile aircraft to them.
(v) To observe and report hostile air activity to the Army and R.A.F. Intelligence Branches.

The true criterion of the value of A.A. fire is not the number of aircraft destroyed but rather by the measure of what more the enemy could have accomplished in the absence of anti-aircraft activity.

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(C). *The adequacy of existing resources to deal with probable future commitments.*

This question involves a brief consideration of the conditions under which we may be engaged in a war of primary importance against an enemy whose air power is considerable. Broadly speaking the possibilities are two :—

(i) In Europe as an ally of a Continental Power.

(ii) In the near or middle East in defence of Egypt, Iraq, or India.

The stalemate that existed so long in the late war, and the long period of economic distress that followed, left such an indelible impression on all participants and onlookers that it is certain that both sides will endeavour to make the next conflict short and decisive. In order to achieve this result, we may expect in a European theatre to find a rapid blow struck at the hostile concentration area by a strong mechanised force assisted by aircraft. In an Eastern campaign, where road communications are scanty and natural features inimical to the use of tanks and tractors on a large scale, we may expect aircraft alone to be employed in an initial effort to damage the enemy's morale and to interfere with his strategical dispositions. In either case it behoves us to ensure that our military counter measures are at least up-to-date, and our organisation quickly and easily expandible.

Our anti-aircraft artillery at home consists at present of two mobile regular brigades. There are also five semi-immobile Territorial brigades grouped round London. These latter might be available for a distant theatre of operations, but would not be touched if there was a possibility of hostile air attack against England itself. Outside the British Isles there is no mobile anti-aircraft artillery, though it is probable that such will replace the Medium Brigade in the Mediterranean. India, with its important strategic centres on the North-West frontier, has nothing in the way of A.A. defences to supplement the action of the R.A.F., who must therefore be relied upon to prevent any single hostile machine from penetrating to our concentration areas, or arsenals. Machine guns and light automatics form part of the equipment of all cavalry and infantry units at home and abroad, also every battery has hotchkiss or Lewis guns, with a limited number of A.A. sights and mountings.

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The above resources in artillery weapons are very small, considering that we may certainly expect to meet great aerial activity at the outset of a campaign, and that most if not all of the A.A. batteries will be employed in the protection of the base and back areas.

Further, the nature of A.A. artillery is such that these batteries cannot be quickly improvised and trained. In order to augment these resources in peace time, it is possible :—

(i) To increase considerably the A.A. branch of the artillery, possibly at the expense of the regular coast defence establishment. This will, undoubtedly, have to be done to a certain extent, but a big increase would be very costly, absorbing funds earmarked for mechanisation or the replacement of obsolete equipment.

(ii) To supplement existing A.A. artillery by training a portion of the Field Army artillery to take part in A.A. defence.

(iii) At the same time it is possible without much expense to give much more attention to the training of light automatic detachments in A.A. fire. At present the effect of well controlled and accurately aimed fire from automatics is not appreciated. It is laid down in machine gun training that the Lewis gun is most suitable for organised aerial defence against aircraft flying low and that the moral effect of such fire is great. This is repeated in Small Arms Training which also states that constant practice is necessary so that fire may be opened rapidly and the heights at which machines fly readily and accurately estimated.

Again, it is definitely laid down in F.S.R., that every commander, in addition to arranging for the protection of his command from surprise by hostile aircraft is at all times responsible, whether on the move or at rest, for dealing with hostile aircraft flying over his command at an altitude not exceeding 3000 feet. Yet, in spite of these resolutions, practically no opportunities are given to train Lewis gunners in the infantry or artillery to use A.A. sights intelligently or to recognise the heights and therefore the range at which aircraft may fly. The difficulty of controlling aircraft action during manœuvres and the impossibility of getting practice against real aeroplanes combine to produce this condition. It is in the interest of our own air forces, who have lost machines through hostile rifle fire

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on the Indian frontier, and in Arabia, that the army should devote serious attention to the handling of light automatics against aeroplanes.

(D). *The nature of Anti-aircraft Equipment and Gunnery.*

The basic factors governing the design of anti-aircraft artillery are the necessity for (i) a high muzzle velocity that will give a short time of flight; (ii) all round traverse; (iii) high angles of elevation; (iv) a rapid rate of fire; (v) ammunition supply capable of dealing with a large expenditure. These factors are of the greatest importance, and any weapon used against aircraft should be designed or be capable of modification to fulfil these conditions. Consequently, the 3″ 20 cwt. A.A. gun used in the forward and back areas has a high velocity of about 2000 ft./sec., has a pedestal mounting that admits of rapid all round traverse, and admits of loading, sighting and firing at high angles of sight, and has a semi-automatic breech mechanism, admitting of a rapid rate of fire. The ammunition is fixed, and is carried by lorry and trailer.

Anti-aircraft gunnery may, in its broad aspect, be divided into :–

(i) Method suitable for engaging aircraft flying above 10° angle of sight.

(ii) Method suitable for engaging aircraft flying below 10° angle of sight.

The distinction is important, and it will be shown that the methods differ considerably as regards their adaptability by other equipments. The main problems presented to the A.A. gunner when firing at high angles of sight are :—

(i) Determination of the present position of the target.

(ii) Prediction of the future position of the target.

(iii) Application of gunnery factors necessary to direct a shell to burst at this future position.

A continuous and instantaneous solution of these problems is necessary. To determine the present position, it is necessary to find the bearing, angle of sight and height. From this must be deduced the future position during the time of flight of the shell plus the dead time, which is the time taken for the data to be applied and the shell to be fired. The main gunnery factors involved lie in the

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determination of vertical and lateral deflections, and the determination of the fuze length necessary to ensure a burst at the future position.

The two main characteristics in which A.A. gunnery differs from ordinary gunnery are :—

(i) That the position of the target is fixed from height and angle of sight instead of range.

(ii) Tangent elevation is obtained from fuze and angle of sight instead of fuze being obtained from tangent elevation. In fact, the tangent elevation dial is graduated in fuze lengths in the A.A. gun, in contradistinction to range in the field army equipments.

It will be recognised that the instantaneous solution of these problems must depend on the use of special instruments, two of which are universally employed. Some form of heightfinder finds the height, and a predictor gives the vertical and lateral deflections and the fuze. The results are communicated to dials on the gun and are put on as deflection and fuze. The above is only a "potted" indication of a very scientific form of gunnery requiring delicate and expensive instruments and a very specialised training both on the part of those responsible for the conduct of the shooting, of the instrument men, and of the gun detachments. A more detailed description is not necessary to show that it would not be practicable to impose this specialised procedure on to a battery for which the engagement of aeroplanes must be a secondary role.

From the point of view of the anti-aircraft gunner, low flying aircraft present two types of target—the machine that dives close to the ground for the very short time during which the pilot is using his machine guns or dropping bombs, and the machine that flies round, at a height of 4000 to 1000 feet engaged on intimate reconnaissance. The former is a target more vulnerable to small arms than to artillery fire, as the attack is too sudden to enable any battery that was not actually in action ready for the attack, to open effective fire. Further, such a machine does not fulfil the three A.A. assumptions of constant course, height and speed during the time of flight. The latter type, the machine flying fairly low on a reasonably constant course is, however, vulnerable to gun fire. Such fire must be of the nature of "eye shooting with aids" and will depend

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more on rough estimates of range and deflection than on the more accurate data given by cumbersome instruments. This is due, firstly, to the fact that such instruments are not designed for low angles of sight and do not give results with the same accuracy as at high angles: secondly, the range and displacement change too rapidly, and the target will often be in a vulnerable position for too short a period, to permit of accurate instrumental predictions, which, of course, take time.

Good results at this form of shooting are best obtained through constant practice, together with a working knowledge of the graphic range tables for low heights, assisted by simple aids which give the deflections appropriate for various speeds and angles of presentation. This form of shooting, in fact, bears some resemblance to shooting at fast moving ground targets, and as such targets are likely to be numerous in the forward areas, they might well be considered as "fair game" for suitable weapons of the field army if such weapons exist, or can be designed without prejudice to their employment against ground targets.

It would be useful at this point to summarise the conclusions that might fairly be reached from the above consideratons :—

(i) The menace of aircraft, and especially of low flying aircraft is likely to be serious.

(ii) Our existing resources are small and should be both augmented and supplemented.

(iii) Shooting at high flying aircraft is a highly specialised form of gunnery and not suitable for adaptation by other weapons.

(iv) "Ground strafing" machines should be taken on by light automatics, and training in this requires much more attention than is devoted to it at present.

(v) Machines flying from about 4000 feet down to 1000 or 800 feet might be taken on successfully by suitable weapons of the field army, which would thus force hostile machines to carry out intimate reconnaissances at high altitudes, interfere with their spotting and photography and protect our own low flying machines to a certain extent from hostile fighting scouts.

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(E). *Examination of the nature and functions of artillery weapons in the field, with special reference to their suitability for A.A. fire.*

In considering such a question we must first deal with actualities, considering the equipments that are now available to accompany an army in the field. Remembering the desiderata for a weapon that can hope to fire with useful effects on low flying aircraft, we can at once rule out all howitzers inasmuch as :—

(i) They have a low M.V. and long time of flight.
(ii) They cannot fire at quick enough rate, mainly because the ammunition is not fixed.
(iii) The ammunition supply would be too difficult a problem.

The 60 pdr. can be ruled out on the score of :—

(i) Slowness of rate of fire.
(ii) Difficulties of ammunition supply.
(iii) Inability to fire at high angles of sight.
(iv) Slowness of traverse.

The 18 pdr. Mk. V would be ruled out :—

(i) Because it has not got all-round traverse.
(ii) Because it cannot fire at an angle of sight greater than 15° elevation.

The 18 pdr. Mk. IV with platform would be fairly suitable in other respects, but for the fact that it cannot fire at an angle of sight greater than 15° elevation. As it employs the semi-independent line of sight system of laying, and is capable of firing at 37° quadrant elevation, it is considered that the elevation gear could, without difficulty, be so modified as to admit of a total of 30° angle of sight combined with 7° tangent elevation. This would make possible the engagement of targets at 4000 feet at a horizontal range not below 2300 yards and at 1000 feet at a horizontal range not below 850 yards. It must be realised, however, that the platform does not give a true all-round traverse, in that it does not allow the layer to follow a target continuously through the sights. It does, however, enable the No. 1 to move the trail rapidly and comparatively smoothly over a wide arc, which will enable the layer to lay and fire on a system similar to the "running past points," but with the advantage of not being restricted by traverse or by having to wait until the aeroplane actually flies past definite features.

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The only weapon that is capable at the moment of dealing with low flying aircraft is the 18 pdr. self propelled (Birch) gun which is at present in the experimental form. It is, however, expensive and unsteady in action. For these and other reasons, among which are its unsuitability for use in forward areas against tanks (because it is so conspicuous) and the fact that the carriage is totally unsuited to commercial use in peace and therefore to mass production in war, it is likely to disappear.

When looking forward to new designs, we must not be carried away by enthusiasm to lay down a weapon ideal for some special purpose, but of little practical use in other directions.

Again, the whole question of the future constitution of our striking force is undecided. It is certain however, that mechanisation will increase and, so far as field artillery is concerned, it is extremely probable that advances will be made in the direction of the six or eight wheeler all-wheel-drive lorry rather than the track vehicle. Speculation is dangerous, but the two desiderata,

(i) That a field gun must not be too conspicuous in action.

(ii) That it must be able to travel at high speed along the road without damage to the delicate parts of the gun carriage,

indicate that a gun mounted on and firing from a sprung trailer drawn behind an all-wheel-drive lorry may have preference over either the tractor-carried gun or the gun on its own wheels towed behind a tractor or lorry.

Such a weapon will not, however, be efficacious against tanks unless it permits of rapid rate of fire and all round traverse, or against low flying aircraft unless it permits of high angles of sight, high M.V., and adequate ammunition supply. The same desiderata should, therefore, be kept in mind when considering new designs, and if the designers cannot produce a gun-howitzer that has these characteristics, then another gun with high M.V. should be adopted whose main functions will be the engagement of rapidly moving targets on the ground and in the air.

We find, therefore, from a consideration of the above, that by utilising existing armament we can by making comparatively small adjustments to the elevating gear, make the 18 pdr. Mk. IV with travelling platform effective within certain limits.

In order to cope with ammunition supply, guns thus employed

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should be mechanically drawn. We could, also, without any difficulty, equip and train personnel to man four light automatics per battery and to make each battery contribute to the general A.A. protection of a column on the road and its own special protection in action and in bivouac. Thus the field gun can be made to help fill the gap between the high flying aeroplane which must be engaged by the regular A.A. battery with its special instruments, and the ground strafing machine which must be engaged by fire from light automatics.

The type of aeroplane that could be engaged usefully by field guns is that seen from the guns, or reported by forward observers to be making an intimate reconnaissance of our forward dispositions, flying in front of, or over, our forward zone at heights between 4000 and 1000 feet. It is probable that, under existing conditions, the safest heights for hostile aeroplanes to fly over our troops in the field would be between 1500 and 3000 feet and over 20,000 feet. Further, if aeroplanes find, as they will find, in view of the great strides made in A.A. gunnery since the war, that they suffer heavily at heights between 5000 and 10,000 feet, they will either go up, where they will not see much, or come down to this zone, where the A.A. gun and instruments are not so accurate, and the fire from light automatics not so dangerous.

It is not practicable nor desirable to devise a weapon that can combine the functions of a field army gun with those of an A.A. gun capable of engaging aerial targets at high altitudes. Efficiency at both types of targets, differing so greatly in their presentation and in the methods necessary for their successful engagement could not be attained even in peace time. It would be equally bad policy to detract from the efficiency of the A.A. gun proper by trying to make it take on ground targets, except in emergency, and to detract from the usefulness of the field gun by trying to make it adopt methods employed in anti-aircraft gunnery at high altitudes.

There remains now to consider the anti-tank gun and the close support gun of the future, neither of which weapons have progressed beyond the speculation stage. As low flying aeroplanes are likely to co-operate closely with tanks, it is clear that an anti-tank battery should possess the means of dealing also with such aeroplanes, both by machine gun fire and, in favourable circumstances, by fire from the field gun.

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In considering, therefore, the design of the anti-tank gun this should be borne in mind, and should influence design in favour of a quick-firing semi-automatic, throwing a H.E. shell of from 6 to 8 lbs., as against a gun or heavy machine gun firing a solid projectile. The close support weapon, on the other hand, is not likely to be so adaptable; firstly because its role demands a howitzer or mortar; secondly, because of the difficulty of ammunition supply; thirdly, because it is essentially a weapon of opportunity and must give its whole attention to close support and not be tempted to disclose its position prematurely by engaging aeroplanes.

(F). *Consideration of the effect on organisation, training, and equipment caused by (a) adapting any existing equipments (b) designing future equipments, with a view to the engagement of aircraft at certain altitudes.*

(a) Taking first those equipments that form part of the field army of to-day. It has been shown that the 18 pdr. Mk. IV with platform is the only weapon that could be used in this way after certain modification to the elevating gear. The inception of a policy to make this weapon include suitable aircraft among the targets it would have to engage, would affect organisation in that mechanisation would be introduced to the divisional artillery, and the proportion of guns to howitzers in mechanised field brigades would require modification. The addition of a new type of target would make desirable the abolition of certain roles for which the 18 pdr. is not really suitable. Such roles are smoke screening and single battery shoots with air observation, both of which can be carried out much better by field howitzers. It is considered, therefore, that mechanised field brigades should consist of two 18 pdr. Mk. IV, and two 4·5″ howitzer batteries. This would come into line with the organisation of the majority of field brigades in India, and the moment would be opportune to replace 18 pdrs. Mk. I, by Mk. IV with travelling platform in that country.

Training in the engagement of this new form of target would, of course, be necessary, though difficult to arrange at practice camps. A study of the methods employed by the regular A.A. batteries in "eye shooting" is the first requirement. Target practice could only be arranged by towing at heights and ranges within the limitations of the equipment, but practice could be given at most practice

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camps at home and in India at targets towed at heights between 4000 and 1000 feet moving at different angles across the front. Approaching and receding aeroplanes could, however, only be simulated by launching gliders from aeroplanes; this would not give an accurate presentation of a hostile aeroplane flying in this way, but reasons of safety seem to preclude anything more realistic. Much could be done, simultaneously, by training Lewis gun detachments of all batteries, carrying out practice at these towed targets from splinterproofs affording a limited arc of fire.

An urgent requirement is to bring the Anti-aircraft School into line with the School of Artillery and the Coast Artillery School by locating it where practice at aerial targets, courses and demonstrations can take place all the year round. At present A.A. gunnery is a sealed book to most gunners and it is only within the last twelve months that the Gunnery Staff Course has included this branch of gunnery in its syllabus. If the A.A. School were brought into line with the others and its scope enlarged, knowledge of A.A. principles and methods would be increased, the employment of field guns and light automatics against low flying aircraft could be studied scientifically, and broadcast by means of short courses. Methods of target practice would be improved, miniature ranges for field guns evolved and a general interest in A.A. gunnery, its applications and modifications would result.

The withdrawal of smoke shell from 18 pdr. batteries used in this way would admit of a considerable addition of H.E. and the introduction of a time fuze for H.E., such as the 80/44 with number 8 gaine for use against aircraft, if this were considered advisable. There is, however, a serious objection to the use of time fuzed H.E. against such targets, in that the downward splinter effect might cause serious casualties to our own troops when such shell are used against aeroplanes flying over our forward areas. Although Shrapnel has been discarded by the A.A. batteries proper in favour of H.E. for use against high aircraft, yet it does not follow that the shrapnel used against low flying aircraft would not be as effective as H.E. In fact, it would probably be more effective, owing to the wide cone of dispersion formed by the shrapnel on burst and the very large area that would be swept by the bullets. The pilot and observer in an aeroplane flying low will be much more vulnerable

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to shell fire than when flying high, in that they present a larger target, and will often be in such a position relative to the trajectory of the shell that the armour plate, which may cover the floor of the nacelle in low flying aeroplanes, will be of no protection to them against shrapnel. The area covered by a H.E. burst is not nearly as big as that covered by shrapnel, and in view of this fact, and of the danger caused to our own troops, it is considered that time fuzed H.E. should not be introduced for use against low flying aeroplanes.

The introduction of special instruments should be kept to a minimum, but something will be necessary. The present Barr and Stroud artillery range finder can be used to take ranges to moving targets but is not very accurate or designed for rapid operations; in view of the increasing importance of engaging accurately fast moving targets, an improved pattern of range finder will be required in the near future. This should be based on the design of the U.B. 2. without the intricate machinery by which range and angle of sight are transferred to height readings. An instrument is needed which can be traversed vertically and horizontally to read ranges. The range so found would be used in conjunction with angle of sight to find fuze. A good angle of sight instrument is required for field artillery and this instrument might well be designed with a view to use against air targets. An arrangement is required which will enable the use of the clock ellipse principle for finding vertical and lateral deflections. Eye shooting with aids is always likely to produce more accurate results, but it will be necessary to strike the balance between the provision of such unwieldy and expensive instruments as the Vickers predictor, and the provision of nothing at all.

The following suggestion is offered as a possible basis on which a method of eye shooting with aids could be evolved for field guns. It is assumed that the battery is engaging an aeroplane by Case 1, the fire being controlled from the battery position. The present range is found by rangefinder, the present angle of sight and clock by an A. of S. instrument operated by the G.P.O's assistant. The present angle of sight is automatically set on the gun by the layer following the target through a telescope on the sight bar. It is here assumed that the sighting gear has been modified to allow of 30° angle of sight, as previously explained.

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It remains to find the correct (future) fuze, and the vertical and lateral deflections. These are obtained from cards on which range is plotted against angle of sight on one side, and angle of sight against clock on the other. The fuze so obtained is given to the guns, and lateral deflection is given to the layer who puts it on the telescope bar. The T.E. corresponding to future fuze and the vertical deflection are applied to the gun by means of a T.E. dial. On this dial are curves of future fuze and an arm graduated in angles of sight with a displacing slider to apply vertical deflection so as to bring the appropriate fuze curve to future angle of sight, thus applying the correct T.E. The T.E. plate is also rocked to apply vertical deflection in addition to T.E.

It is suggested that the cards described above be provided for aeroplane speeds of 80, 100 and 120 m.p.h. Target speed would have to be estimated, through a knowledge of the type of aeroplane engaged, and of the force and direction of wind. The procedure would have to work to a fixed time, as is done in A.A. plotter series, the time to which a trained detachment could work being determined by trials. It will be seen that no expensive nor peculiar instrument would be required, except a T.E. dial and pointer, an extra rangefinder and the cards. The fire can be directed by the G.P.O., assisted by the G.P.O. A.

(b) Looking to the future, it is safe to assume that mechanisation will have made great strides, and that the bulk of the artillery of the Field Army will be drawn by tractors or multiple wheel lorry. It is logical to assume that the anti-tank gun (as distinct from anti-tank machine gun) will be mounted on a similar chassis to that of the medium tank and will work in close co-operation with tanks. As aeroplanes will work in close co-operation with and against tanks, this anti-tank gun should be able to engage aircraft up to 400 feet.

The main gunnery problems will be prediction for fast movement on the ground and in the air, and prediction of future fuze range. There is no logical reason why the present Royal Tank Corps should replace either the infantry or the artillery, and from the point of view of economy, tradition, simplicity of organisation and command, it would be not unreasonable to predict that the tank, tractor, and multiple-wheeled lorry will have found their level as a means of bringing the infantry and its supporting artillery

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to and through the hostile army. These anti-tank guns would be organised in batteries, and it is suggested that the light brigade of the future would consist of two light gun and two light howitzer batteries, the former dealing mainly with tanks and low flying aircraft, and the latter putting up smoke screens, dealing with anti-tank defences, and supporting closely that portion of our infantry that was fighting on its feet.

As regards the field artillery, it is probable that the method of traction will be the multiple-wheel lorry, and it is suggested that the gun of this branch will be carried on a sprung trailer, either on a modified travelling platform or on a low pedestal mounting. Designed thus to give all round traverse and to permit of the gun firing up to 75° quadrant elevation at a muzzle velocity approaching 2000 ft./sec., it will be able to engage quick moving ground targets and aircraft flying low almost vertically overhead. It may be found that a gun-howitzer of about 4″ calibre can be designed and mounted in such a way as to give, with its full charge, a high M.V., rapid loading and rapid rate of fire, but it would be false economy to sacrifice these three essentials for the successful engaging of fast moving targets, to a desire to standardise equipments.

The above suggestions give a basis for estimating what may form the artillery of the field army of the future. Considering a mechanised division of three infantry brigades, each brigade providing the troops and vehicles for :—

(a) Tanks and their crews.
(b) Light and heavy machine guns and their crews mechanically drawn.
(c) Troops armed with rifle, bomb and bayonet, brought mechanically to their position of deployment.

Such a division would require :—

(a) One light brigade consisting of two 6-gun light self propelled batteries armed with semi-automatic guns firing a shell of about 8 lb. weight, and two 6-gun light howitzer batteries, either self propelled or trailer carried.
(b) Three field brigades, each consisting of two 6-gun batteries and two 6-howitzer batteries, the motive power supplied by multiple-wheel lorries and the weapons carried on sprung trailers.

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(c) At least two mobile A.A. batteries either forming part of the division or allotted to it by Corps Headquarters. The main role of these batteries will be to cover the zone between 3000 and 20,000 feet and to provide additional Lewis guns for A.A. defence at vital spots.

If, in addition to the above, all batteries pay attention to the training of their A.A. Lewis gun crews, which should number at least four guns per battery, the division of the future should have adequate protection against aircraft at all heights.

It will not be easy to achieve realistic training with the mechanised army of the future, and the portion of its training which will be most difficult to make realistic, will be that connected with aeroplanes. The latter are able to carry out, during peace manœuvres, tasks that would be impracticable in war. It is obviously impossible to fire at aeroplanes in peace time, and, as shown earlier, it is difficult to reproduce at practice camps all the conditions under which aeroplanes could be engaged as targets in war. The provision of aeroplanes unpiloted but controlled by wireless would be realistic but far too expensive. A direct hit on one of them would be regarded by a battery commander, who was also a taxpayer, with mixed feelings. Much could, however, be done at an A.A. school by the help of carefully designed miniature ranges, and it should be possible to devise a telephoto lens camera pivoted parallel to the axis of the gun and rocking so as to conform to the theoretical trajectory of a shell, exposing a film at the moment given by the fuze length ordered. Again, practical experience gained in the trials with the 18 pdr. would enable a method of engaging air targets to be standardised, and would show what special instruments were needed.

It is possible that with the increase of mechanisation, the ammunition problem will be made more difficult by the abolition of shrapnel which is not of much use against armoured or semi-armoured vehicles. In such an event, H.E. with time fuzes would be used by field guns against aircraft, without fear of causing casualties to our troops, the bulk of which would be in vehicles, and not much exposed to fragments.

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Conclusion.

In a subject like this, which deals with a branch of the Regiment still in its infancy, almost unknown to the rest of the Army, being, as it were, a link between the Army and the Air Force, it is necessary to avoid extreme views. On the one hand, there are many who state that A.A. gunnery is quite different from ordinary gunnery, and there is no meeting point. On the other hand, there is the school who think that a gun should be able to take on any and every sort of target. The answer to the problem appears to be that a compromise must be found. Admitted that aircraft present an ever-growing menace to the conduct of operations, then measures must be taken to counteract them. Admitted that A.A. gunnery at high altitudes presents a problem quite different to that presented by objects on or near the ground, then this problem must be solved by the special instruments held by the A.A. batteries. Admitted that the increase of mechanisation will lead to more low flying, then it is imperative that means should be devised to make such low flying costly to the aeroplane. It cannot be emphasised too strongly that the antidote to the ground strafing aeroplane is the light automatic, and that much more attention should be devoted to the use of this weapon against aeroplanes, even up to 3000 feet. It cannot, however, be expected that many casualties will be caused at the moderately low heights especially as the aeroplane of the future will probably have the bottom of the engine and fusilage lightly armoured.

It is here that the light gun and field gun can be useful, without prejudice to their other functions. Their use will not be a popular innovation; there will be many who will not think that any good purpose can be served by practising at this form of target, which will usually, in peace, be unrealistically represented. Yet the power to deal with quick movement is a great asset. The battery which can burst shell near an aeroplane flying at 120 miles an hour will have no difficulty in dealing with a tank attack, and the army that can deny to the other that valuable information gained only by intimate air reconnaissance will have an enormous advantage.

It has been contended that the future belongs to air forces: perhaps our potential enemies hold this doctrine. It behoves us, therefore, to see that we are able to counter their efforts, from whatever height they may choose to attack.

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LUDENDORFF'S LAST GREAT BID FOR VICTORY.

By Major-General Sir Edmund Ironside, K.C.B., C.M.G., D.S.O.

UNDER the heavy hand of the Great General Staff, the German military authorities have never been inclined to supply documentary evidence in support of the published stories of their successful campaigns, and it is therefore not surprising that the histories of the late war, where they were unsuccessful, should prove no exception to the rule. It is only when a controversy arises as to the conduct of operations, and now that the Great General Staff has disappeared, participants publish their personal recollections, that we can reach the truth. Such a controversy now rages on the subject of the German attack in 1918 and is therefore of especial interest to the British Army.

This last attack directed by Ludendorff is probably one of the most important in the whole history of the war, and is certainly worthy of careful study. Its failure made certain the defeat of the Central Powers. To-day, some may think that the Germans' chance of final victory at this period was not great, but at the time to them, prospects must have looked bright. Could either the French or British be defeated, further transfer of United States' troops might be checked and the moral of the Entente thus broken. The whole German nation was certainly behind the attack and confidence was undoubtedly higher than it had been since the failure of the original campaign of 1914. The study which follows is an attempt to trace the reasons for the German failure.

Writing long after events, Ludendorff has given us his own account of how he initiated and prepared his blow against the British Vth Army. He sets forth his reasoning as follows:—

"I discussed the selection of the front of attack with the Chiefs of Staff of the Army Groups and with the officers of my Staff and heard their opinions. Three sectors were considered—Flanders between Ypres and Lens—Between Arras and St. Quentin or La Fère—On both sides of Verdun leaving out the fortress. As is always the case, there was a great deal to be said for and against each proposal. . . .

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I favoured the centre attack, but I was influenced by the time factor and by tactical considerations, first among them being the weakness of the enemy. Whether this weakness would continue I could not say. Tactical objects had to be considered before pure strategy which it is futile to pursue unless tactical success is possible. A strategical plan which ignores the tactical factor is foredoomed to failure. Of this the Entente gave numerous examples in their attacks during the first three years of the war."

Ludendorff would thus have us believe that he chose his front of attack for tactical reasons. Such a statement coming from a man of his calibre cannot be passed without comment. Owing to the particular circumstances of trench-warfare, which had arisen after three years of static fighting, Ludendorff was faced by two distinct problems. First, the tactical break-through against a strong enemy trench-system, and second, the exploitation of success in the open country behind this trench-system. Naturally, if the tactical break-through failed there could be no exploitation. No one can blame Ludendorff for having had the greatest of respect for the trench-system which was in front of him, and for choosing a portion of it for his break-through which offered a good chance of success. But, a great strategical success was the only thing which could save the Germans at this stage, and if his chosen front of attack did not offer the chance of such success after the break through, then his plan was a faulty one.

It is interesting to recall the teaching of the elder Moltke on this subject:—

"One cannot even plan the concentration of the Army without having first conceived a strategical plan, at least in its general features. One must have considered what is to be detailed for defence and what for offence, for this concentration of the Army cannot be separated from the operations themselves. Any mistake in the initial concentration of the Army can hardly be rectified at any time in the campaign."

The story of the birth and growth of the March offensive of 1918 appears to be as follows:—

On the 9th November, Lt.-Colonel Wetzell, the Chief of the Operations Branch, put before Ludendorff a paper in which he pointed out that no attack on the Western front should be attempted

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unless it promised a great strategical success. He gave it as his opinion that there was only one point at which such success could be achieved and that was at Verdun. Not only would the material advantages of success in this region be very great, but the moral advantages also might be incalculable. By attacking wide of the fortress and on either side of it, the eleven French divisions defending the salient would be destroyed or captured, and the fifteen German divisions now facing the salient would be set free for strategical operations. Such a success would put out of court any question of a Franco-American offensive in 1918, and the Germans might then turn their attention to the British. As regards these he was of opinion that there were two possibilities of attack :—

(i) Near Armentières.

(ii) Near Hazebrouck.

The first attack had little chance of achieving the great success which was needed. The British positions were in great depth and their reserves were close up. The attack near Hazebrouck was more hopeful. Could this important railway junction be reached the British supply arrangements might be upset and their whole line compelled to retire. Wetzell then closed his paper with these words :—

"Nevertheless, with the closely massed British reserves, the prospects of this by no means easy attack do not appear to me to be any too great. It is, however, to be preferred to that via Armentières on account of its strategical possibilities. It can, by carrying the surprise attack towards the Portuguese front, lead to good results. Whether the waterlogged country and the strong British reserves will permit of a quick exploitation of success, can only be settled on the spot and appears to me to be most doubtful."

This paper must have been fresh in his mind when, two days later on the 11th November, Ludendorff held a conference at Mons of the Chiefs of Staff of Rupprecht Group (Von Kuhl) and German Crown Prince Group (Von der Schulemberg). Von Kuhl was most emphatic in recommending an attack between Armentières and La Bassée in the general direction of Hazebrouck, in order to attack the British forces in the Ypres salient in flank and rear. Von der Schulemberg was equally insistent that the only place at which to attack was Verdun. Each chief of staff thus favoured strongly an attack on his own front.

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Ludendorff decided at once against Wetzell and German Crown Prince Group. He agreed that operations against the British in the direction of Hazebrouck might prove very effective, but the difficulties of terrain were great. Moreover, such an attack was dependent on the weather and could not be made early enough in the year. It was, indeed, possible to attack the French first and so fix them, and then to turn against the British. Unfortunately, numbers and stocks of ammunition did not permit of two big offensive operations. He gave it as his opinion that more favourable conditions might be found further south. An attack about St. Quentin appeared particularly favourable. If the line of the Somme from Péronne to Ham could be reached, then by resting the left flank on the Somme at Péronne and advancing north-west, the British line to the north might be rolled up.

At the conclusion of the conference the two Chiefs of Staff were ordered to base their proposals for action upon the following conditions:—

(i) That the British were to be defeated.

(ii) That some 35 divisions and 1000 heavy guns would be available for the attack.

(iii) That the attack must take place as early as possible in 1918—at the end of February or the beginning of March.

Ludendorff thus gave his subordinates a clear and simple general idea—the defeat of the British. He gave them about 3½ months in which to stage their operations. He indicated to them what he considered the most favourable point of attack—the area about St. Quentin—striking thus almost at the British right, which came a little south of Péronne.

By the 20th November Rupprecht Group had replied that they were not in favour of Ludendorff's plan and that they still preferred the offensive in the direction of Hazebrouck. As regards the St. Quentin offensive they put forward the following points for consideration. Decisive operations would be so far from the Flanders front that their immediate objective could not be the main British forces in that area. Attack against the flank and rear of these forces was not possible as was the case with the Hazebrouck offensive. How such could be achieved later in the operations proposed by Ludendorff was not evident. An attack against

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St. Quentin would indeed prevent any contemplated British offensive in Flanders, but that was not in itself sufficient justification for a German offensive. The Group then concluded by saying that the St. Quentin offensive would require much greater strength than the Hazebrouck offensive, for it aimed firstly at a break-through and then at a struggle in open warfare with the main British and French reserves, for which these latter would have considerable time to prepare, owing to the distance of the strategical objective from the scene of the break-through. With the Hazebrouck offensive the British reserves would have no time to prepare. They also pointed out that the St. Quentin front faced south-west, whereas the offensive after the break-through was to be directed north-west. This would entail a difficult wheel, most probably across shell-shot broken country.

Rupprecht Group were thus in open disagreement with Ludendorff as to the plan for defeating the British. They did not fear the tactical break-through so much as he did and thought more of the strategical results to be gained after the break-through.

The British surprise attack at Cambrai on the 20th November and the German counter-attack on the 30th taught Ludendorff many valuable lessons. He found that his counter-attack was held up sooner than he had expected. His men did not excel in the short period of open warfare which ensued. There were grave faults in the supply and transport arrangements. Many doubts arose in the minds of both leaders and troops as to the possibility of achieving open warfare. If the enemy had been attempting this task for two long years, how were the Germans to effect it against even stronger defences than those which the Entente had been forced to face? There was, however, a small school of thought in the German Army which labelled those who had been long on the Western front as pessimists. Great results had been obtained on other fronts—in Russia, Rumania and Italy. The same could be gained in the West also if only the proper methods were employed..

As the lower formations commenced the study of the offensive the tactical difficulties of the break-through began to loom larger. Fresh units coming in from the East reported freely upon the defences in front of them. Those north of Arras were stronger

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than anything that had been seen in the East. Those between Arras and the Oise were the only ones approximating to those they had previously faced. Gradually Ludendorff's attention became more and more fixed on this area. Both defences and enemy numbers were weak. The British defences were undoubtedly weak, for the movement of the Cambrai battle and the voluntary retirement of the Germans from the Somme battlefield had not given the time necessary for the construction of fresh defences. The necessity of ensuring the safety of the Channel ports also forced us to be stronger in men in the north than in the south of our line.

The expression of all these tactical fears evidently had its effect upon Wetzell, for he drew up a paper on the subject. He pointed out that an offensive in the West was quite another matter to an offensive either in the East or in Italy. A surprise attack would undoubtedly give the German troops a start, but heavy counter-attacks must be expected soon after the commencement of operations. Only by a combination of several attacks at different points but in close combination with one another could great results be achieved.

Rupprecht Group put forward a proposal in a similar refrain on the 5th December. Unless surprise could be effected a break-through would be difficult. Surprise could only be brought about if a "shortened" method of attack could be employed, and this meant that some point in the enemy's line must be chosen which was comparatively weak. They considered that the offensive should be divided into two phases :—

(i) A blow on the front Cambrai—St. Quentin.

(ii) A second blow, delivered about 14 days later, in the general direction of Hazebrouck.

The objective of the Cambrai—St. Quentin attack should be the envelopment of the British forces in the Cambrai salient and the breaking of a great gap in the British line, which would compel the withdrawal of reserves from Flanders in order to restore the situation. The objective of the Hazebrouck offensive should be to take the Flanders front in flank and rear and finally to roll up the whole British line.

Rupprecht Group were evidently more frightened of the tactical break-through than they had been before they began to

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study the question in detail. They now suggested a method of drawing away the British reserves, thus weakening the line in men on the front they preferred for strategical reasons.

On the 17th December Ludendorff issued orders for the XVIIIth Army to take over the sector on either side of St. Quentin, the southernmost portion of Rupprecht's line. This change was to prove an important one. The XVIIIth Army was under the command of Von Hutier, the man who had carried out the attack on Riga—the attack which has been called the rehearsal of the March offensive.

On the 27th December Ludendorff issued orders for the following operations to be staged :—

Rupprecht Group.

(i) *St. George II.* (Attack against the Ypres salient) in conjunction with *St. George I.* (Break-through in the neighbourhood of Armentières).

(ii) *Mars.* (Attack against the Heights of Lorette—Arras).

(iii) *Michael.* (Attack on the front of the IInd and XVIIIth Armies).

In the direction of Bullecourt—Bapaume (Michael I).
In the direction of Péronne—St. Quentin (Michael II).
In the direction of St. Quentin—La Fère (Michael III).

German Crown Prince Group.

(i) *Hector.* (Withdrawal of the IIIrd Army in Argonne).

(ii) *Achilles.* (Counter-attack of the Ist Army in Champagne).

Duke Albrecht Group.

(i) *Strassburg.*

(ii) *Belfort.*

All preparations were to be completed by the 10th March 1918. Army Groups were to give no indication to the Armies as to the actual attacks which were to be carried out.

As the winter drew on the spirits of the Germans rose steadily at the idea of an offensive which would really finish the war. All ranks felt in their hearts that only a great offensive could bring success. Ludendorff proved himself a genius at organising the training of his troops behind the line. Excellent progress was made

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in open warfare methods, and the supply and transport authorities studied the question of dealing with the difficult operations following a break-through. Ludendorff had no illusions as to the nature of the struggle which was before him, for early in January he wrote to the Chancellor urging him to lose no opportunity of making use of propaganda to help the coming offensive. His final words were :—

"The military decision between Germany and England is now upon us. For the outcome of this struggle the power of endurance of the British home-front is of the greatest importance. Will this break down under the weight of the military blow or not? That is the decisive question."

The next event of interest was the taking over of more line by the British from the French. Between the 10th and 12th January the British Vth Army extended the line to just south of St. Quentin, and by the first few days of February had assumed control as far as Barisis, south of the Oise. This move placed the British right some 25 miles south of Péronne, the left of Ludendorff's proposed offensive against the British. General von Sauberzweig, Chief of Staff of the XVIIIth Army, was delighted and wrote to Wetzell on the 16th January :—

"It is now certain that the British have taken over the front of the 3rd French Corps. They are also due to take over from the 37th Corps up to the Oise, which will become the boundary between the French and British.

The XVIIIth Army will only have British against it and the situation is therefore more favourable.

The first thing is to beat the British. It is not to be thought that the French will stretch their legs and come in haste to the help of their friends who are being attacked. They will wait first to see whether their front also is to be attacked, and will only decide upon the support of their ally when the situation is thoroughly clear. That will be late, for German Crown Prince Group will also undertake attacks against the French to deceive them.

If our attacks succeed—of which I have no doubt—we shall be on the Somme—Crozat Canal in two or three days. This line will not be passed. All reserves will be drawn off to the north-west and put in with their left on Péronne."

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Ludendorff was not so pleased at the change, for though he must have realised that the taking over of more line by the British—his main objective—must cause a weakening of their reserves available to meet the coming attack, his plans were to some degree upset. He would have preferred to have French troops holding the southern portion of the front of attack he had chosen. He wished the French reserves immediately available to waste themselves against the strong line of the Somme—Crozat Canal in attempts to recover the lost portion of their line, and he did not wish to meet them coming up wide of the gap and during the open warfare period. He had not sufficient troops and munitions, as we know, with which to make two big offensives, and small offensives against strong trench-lines, for the purpose of misleading the enemy, were expensive and did not in practice deceive the enemy for long. He began to have misgivings as to his power to attract the French reserves away from the British area.

On the 20th January he held a meeting of the Chiefs of Staff of Army Groups and Armies. Opinions again differed widely. Rupprecht Group still showed a decided preference for the attack in the direction of Hazebrouck and persisted in regarding any attack at St. Quentin as a preliminary operation. Ludendorff, by this time, had evidently had enough of Rupprecht Group's opposition, for on the 24th January he made some important changes. The XVIIIth Army was transferred to German Crown Prince Group, and the dividing line between the two groups fixed as the Omignon brook. The XVIIth Army was inserted north of the Cambrai salient between the IInd and VIth Armies. Definite preliminary orders were issued the same day for Michael attack. Details were as follows:—

The XVIIth Army was to attack towards the line Croisilles—Bapaume (Michael I). The IInd Army north of the Omignon brook (Michael II). The XVIIIth Army south of the Omignon brook (Michael III). Two other attacks were to be staged, ready to be launched some days after Michael attack, one by the XVIIth Army south of the Scarpe (Mars South) and the other by the VIIth Army south of the Oise (Archangel). The objective of Michael attack was given as the breaking through of the enemy lines to the Somme on the line Péronne—La Fère, followed by an advance

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in conjunction with Mars South to the north-west on a front Arras—Péronne. The attack south of the Oise was to be a blind to deceive and hold the French.

Nothing could be clearer than this plan. Offensive and defensive roles are allotted most clearly, and strategic objective is simple. The comparative strengths of the three armies involved are as follows:—

	Mobile Divisions.	*Position Divisions.*	*Batteries.*		
			Field.	*Medium.*	*Heavy*
XVIIth Army ...	15	2	315	208	16
IInd Army	15	3	250	196	11
XVIIIth Army ...	19	5	385	297	28
Total	49	10	950	701	55

In addition, Ludendorff kept three divisions in reserve.

Ludendorff gave as his reason for bringing in German Crown Prince Group, the fact that he wished to be able to influence the battle more than he would have been able to do with one group only involved. With one group only taking part, and especially with that group Rupprecht Group, any interference from above might be resented. In the state of his relations with Rupprecht Group this may have been a very valid reason, but the fact remains that from the insertion of German Crown Prince Group the principle of using the greatest weight against the British began to fade into the background. Initiative came from the Southern Group and not from Ludendorff. The machine began, in fact, to be driven along by the active Von Hutier in the XVIIIth Army, the very strength which had been given to him allowing him to force the hand of the director of the operation. There are no actual signs of this in written orders or memoranda until the end of February. On the 28th of this month, however, the liaison officer between Ludendorff and German Crown Prince Group made the following report:—

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"The XVIIIth Army brought up the question of the advisability of holding ready a division of the VIIth Army for the purpose of advancing through La Fère. Group asks for permission for this."

A reply was sent on the 3rd March and was in Ludendorff's own handwriting. It ran as follows:—

"Agreed. If Michael goes quickly and well it is advisable for the left flank of the XVIIIth Army to advance across the Canal. For this purpose as many divisions of the VIIth Army as possible are to be held ready to advance through La Fère."

Here is a very definite project for offensive action away from the main objective—the British in the north-west. German Crown Prince Group was quick to press this idea of offensive action, for on 6th March they wired to Ludendorff:—

"If Michael remains an attack with limited objective then the advance by La Fère and the Crozat Canal via Tergnier will soon run to a stop, even if carried out with strong forces and supported from Jussy. It is quite another thing if Michael leads us over the Somme and the French cross the line Roye—Noyon in counter-attack. Such a blow will gain in importance if the French attempt to replace the defeated British on the Crozat Canal."

On the 10th March the final orders for the offensive were issued. They ran as follows:—

Chief of the General Staff.
I.a. 7070.
G.H.Q. 10.3.18.

His Majesty orders

1. Michael attack will take place on the 21st March. Break-through the enemy front line at 9.40 a.m.
2. Crown Prince Rupprecht Group will envelop the British in the Cambrai salient as first great tactical objective, and will advance to the line Croisilles—Bapaume—Junction of the Omignon brook with the Somme. If the attack goes well the right flank (XVIIth Army) will extend beyond Croisilles.

   The further task of the Army Group is to push forward in the direction Arras—Albert, the left flank resting on the Somme at Péronne. Main strength on the right. Objective, to shake the British front before the VIth Army and to set free further forces from trench-warfare for the advance. All divisions

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behind the IVth and VIth Armies are to be brought up without delay should this phase be reached.

3. German Crown Prince Group will gain the line of the Somme—Crozat Canal south of the Omignon brook. By rapid forward movement the XVIIIth Army is to seize the crossings over the Somme and the Canal. Thereafter, the XVIIIth Army will hold itself in readiness to extend its right to Péronne. The Group will ensure that the left flank of the XVIIIth Army is strengthened by divisions of the VIIth, Ist and IIIrd Armies. . . . . G.H.Q. will decide as to Mars and Archangel attacks, according to the state of the operations. Preparations for these attacks will continue uninterruptedly. . . . .

Von Hindenburg.

There is no indication of offensive action in the south in this final order, but the intention becomes much clearer in the subordinate orders. On the 14th March German Crown Prince Group ordered as follows :—

"The XVIIIth Army will break through the enemy positions between the Omignon brook and the Oise with its main strength on its right, seizing the crossings over the Somme and Crozat Canal between St. Christ and Tergnier (both inclusive) ready for a further advance."

The XVIIIth Army had issued its preliminary orders on the 4th February to the effect that the line of the Somme—Crozat Canal was not to be passed, but they now formulated a new plan in a paper to German Crown Prince Group on the 15th March :—

"If the enemy is driven over the Somme—Crozat Canal by the XVIIIth Army he will certainly try to hold this sector, if only to assure the bringing up of reinforcements via Roye—Amiens for action against the IInd and XVIIth Armies. Therefore a speedy occupation of this sector is necessary. Loss of time on our side will only strengthen the enemy's defence. . . . .

Immediately the Somme and Crozat Canal are crossed it will be the objective of the XVIIIth Army to draw upon itself the French reserves coming up to support the British, to beat them and to cut the communications between French and British. It is probable that the French will bring up strong reserves by the rail-sectors Roye—Chaulnes and Montdidier—Amiens, in order to

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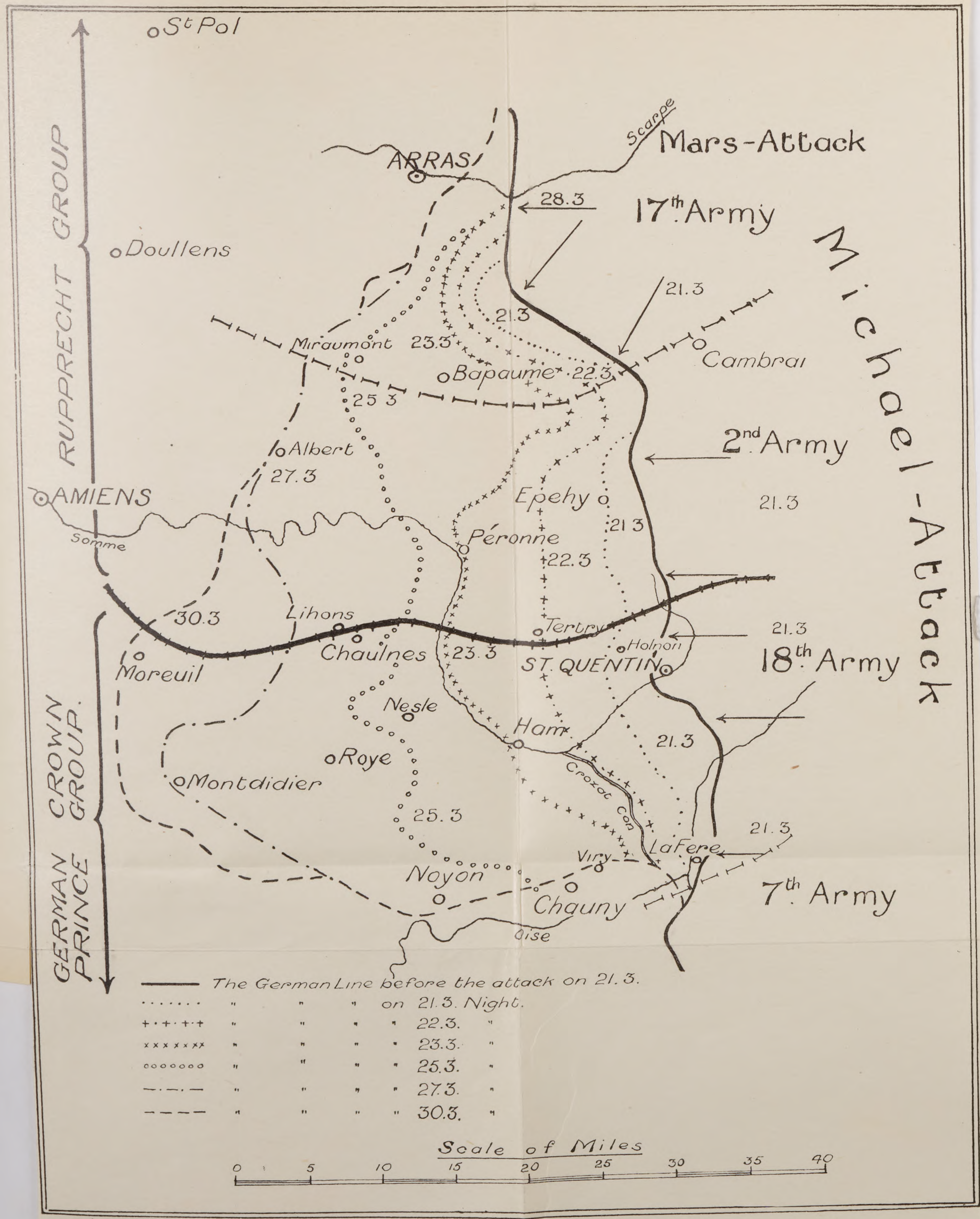

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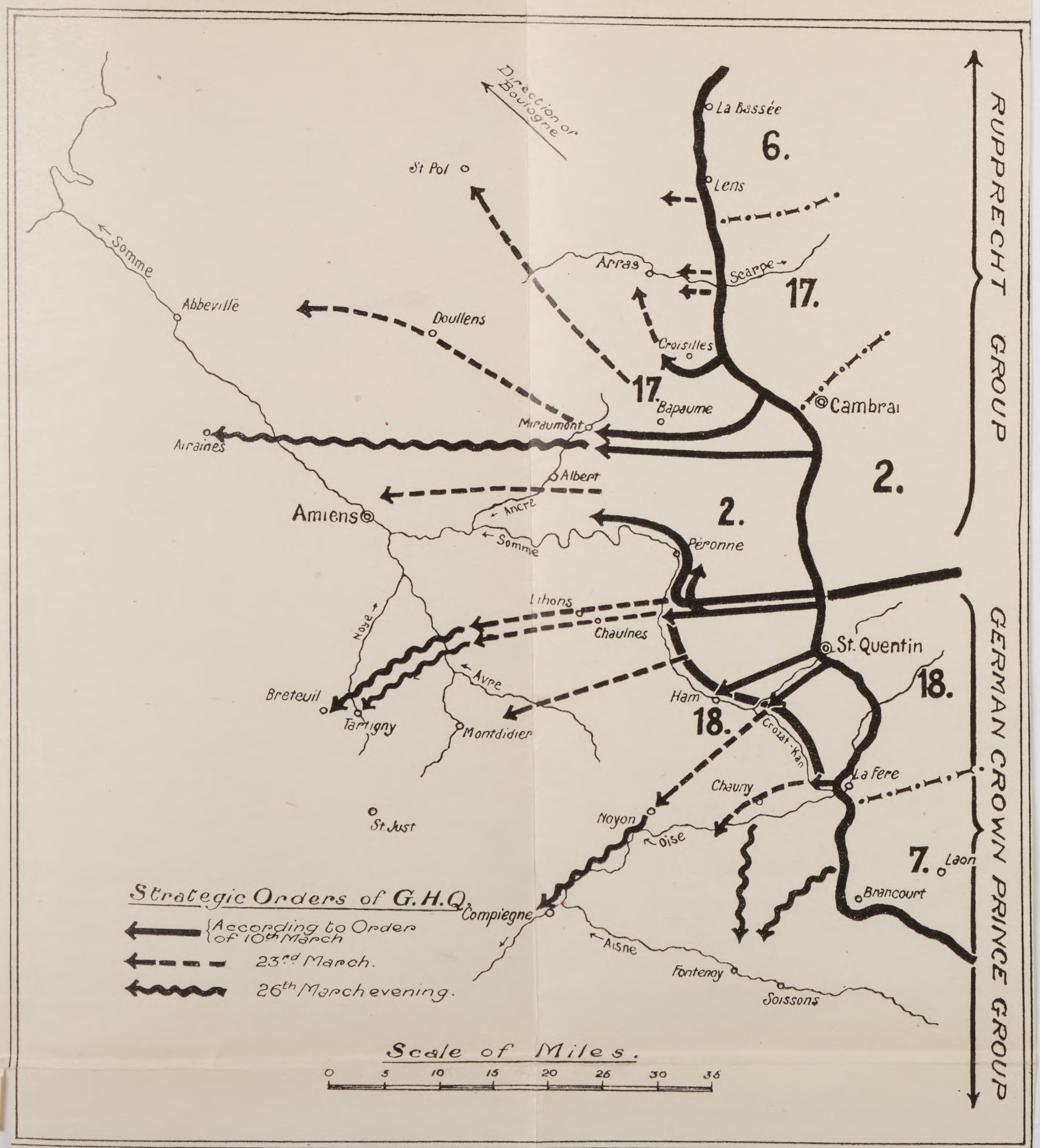
Direction of Boulogne
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6.
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Péronne
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Chaulnes
Noye
St. Quentin
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Breteuil
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Crozat Kan
La fere
Chauny
Noyon
St. Just
Oise
7.
Laon
Brancourt
Compiegne
Aisne
Fontenoy
Soissons
RUPPRECHT GROUP
GERMAN CROWN PRINCE GROUP
Strategic Orders of G.H.Q.
According to Order of 10th March
23rd March.
26th March evening.
Scale of Miles.
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attack below Péronne against the flank of the IInd and the front of the XVIIth Armies. . . . .

The objective of the XVIIIth Army demands decisive quick operations both in the capture of the Somme—Crozat Canal and in its further advance. The earlier the Army reaches the line Roye—Chaulnes, so much more can it count upon striking the French when still in movement and all the more favourable will be the conditions of moving warfare."

In forwarding this paper to Ludendorff German Crown Prince Group added the following foot-note :—

"The more the strength of the French against Rupprecht Group, the more effective will this action be. Therefore the operation must be allotted great strength."

Gone is the idea of a defensive front in the south. There are now to be two distinct operations, one to the north-west and one to the west. The first to roll up the British and the second to ward off the French coming up to help the British. Two distinct offensives diverging from one another. Here was the very thing that Ludendorff wished to avoid—mobile warfare against the French reserves. Ludendorff had been diverted from his strategic objective before ever a shot had been fired. That Ludendorff was fully aware of what was going on is beyond doubt, for on the 20th March, the day before the attack he spoke on the telephone to Rupprecht Group and explained his thoughts as to the further objectives of the Armies *if great success were obtained.* The XVIIIth Army was to advance on Bray—Noyon, the IInd on Doullens—Amiens and the XVIIth in the direction of St. Pol.

The course of the March offensive is well known and the two maps show the actual progress of the fighting (Map I.) and the various strategic orders issued by Ludendorff (Map II.).

It cannot be said by the morning of the 23rd March that great success had been obtained in the direction of the main objective. The XVIIth Army had met with strong opposition and had not been able to push forward—certainly not to push its northern flank beyond Croisilles. And yet, Ludendorff issued orders for the operations he had sketched to Rupprecht Group on the 20th March. Issued at 9.30 a.m. on the 23rd they ran as follows :—

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"The XVIIth Army will attack strongly in the direction of Arras—St. Pol with left flank on Miraumont.

The IInd Army will advance on Miraumont—Lihons.

The XVIIIth Army, echelonned on its left will advance on Chaulnes—Noyon, keeping strong forces moving via Ham."

Here was dispersion worse than ever. Three offensive movements ever diverging more as the advance continued. Ludendorff seems to have been carried away by the successes of the XVIIIth Army, for on the afternoon of the 23rd March he met the Chiefs of Staff of the two Army Groups in Avesnes and expressed his ideas as follows:—

"A large part of the British Army has been defeated. The British may be counted as having about 50 divisions. It is no longer probable that the French are still in a position to carry out a relieving offensive. They will be involved on Michael front. They have about 40 divisions at their disposal.

The objective of operations is now to divide the British and French by a quick advance on both sides of the Somme. The XVIIth and VIth Armies, later the IVth Army will continue the attack against the British north of the Somme to throw them into the sea. They will attack successively at fresh points (Mars, Walkure, etc.) in order to roll up the whole Britsh front. The XVIIth Army will move on St. Pol with its left on Doullens—Abbeville. South of the Somme the offensive against the French will continue towards the line Amiens—Montdidier—Noyon and thence south-westward. The IInd Army will advance on both sides of the Somme on Amiens in close liaison with the XVIIIth Army."

During the 24th and 25th the advance continued so well that on the 26th these ideas were converted into definite orders and issued on the 26th. But, this divergent offensive was too much for the German effectives and each in turn was brought to a stand. The failure of Mars attack on the Scarpe then brought this phase of the offensive to an end.

Ludendorff had failed to achieve either the defeat of the British or their separation from the French. Looking at the Somme from La Fère to Amiens (Map II.) one cannot but be struck by the fine conception of Ludendorff's first plan. He had drawn for himself a magnificent defensive flank against which the French

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might have expended themselves in vain. It is true that his flank attack against the British was situated too far south strategically, but he was forced to that by tactical necessities and the weather. His fault lay in not holding fast to his strategical objective through all the changing tactical situations. He allowed himself to be enticed into an offensive across the Somme, leading as he himself expressed it "into the blue" *(sehr ins Weite)*. He had thought to control the battle better by introducing two Groups into the operations, but had allowed himself to be controlled by the Group which had been allotted the passive role. One cannot but wonder what would have occurred had he placed Von Hutier to carry out Michael I (XVIIth Army) or Mars (VIth Army) where the offensive energy of this able artilleryman would have been set in the right direction.

Ludendorff's failure exemplifies clearly the temptations and difficulties which beset the commander of a great army. There are many events which tend to draw him away from his objective. Local successes push him inexorably towards a policy of following the line of least tactical resistance—the pursuit of the soft spot in the wrong strategical direction. The desire to show immediate results to anxious political watchers and to raise the moral of a people to whom much has been promised is ever present. There is the strong-minded subordinate also, who sees only the portion of the front before him and who never ceases to demand more freedom of action from his superior. All these various influences exert a pressure difficult to resist.

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E/B R.H.A. AT MAIWAND,

27th July, 1880.

By Captain H. B. Latham, R.H.A.

IN nearly every "Gunner" mess hangs the print which is reproduced in the Frontispiece. To those who have been sufficiently interested to study it, it is clear that the gun in the foreground belongs to No. 4 Subdivision of "E" Battery, "B" Brigade, Royal Horse Artillery,[1] for it was at Maiwand that this battery by its magnificent fighting qualities, high morale and steady discipline added another page of glory to the history of the Regiment. Unlike most of the actions described in this Journal the Battle of Maiwand was a disaster, and was fought on the 27th July 1880—during the later stages of the Second Afghan War.

There can be now but few survivors of the men of the battery who were present on that occasion, since they were nearly all "old soldiers" at the time. Three are, however, known to be still alive, Gnr. Williams of No. 4 Subdivision, Gnr. Naylor, limber gunner of No. 2, and Gnr. Adams, now a Chelsea Pensioner.[2]

The writer's intention is to bring to notice once again, an action of which we as "Gunners" must always be proud, for when all seemed lost and disaster had overtaken the greater part of the small British force, the majority of the guns were got safely away though the enemy were fighting the gunners hand to hand around them.

In order to understand what actually occurred in the battle itself, it will be necessary to give a brief précis of the previous events of the Second Afghan War, which led up to it. A war which, to the student of military history is so full of dramatic episodes, but which at the time appeared no more fruitful of results than our previous invasion of Afghanistan had been in 1839-42.

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[1] Now the 58th Field Battery, R.A.

[2] It would be interesting to know if there are any others.

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Lord Lytton, who had succeeded Lord Northbrook as Viceroy of India in 1876, was bent on carrying out a "forward policy" with regard to Afghanistan, when the action of Russia in 1878 gave him the chance for which he was eagerly waiting. Russia had quickly overwhelmed Turkey in the Russo-Turkish War of 1877-78 and had only been prevented from inflicting a disastrous peace upon her adversary by the action of England, who in concert with Austria and Germany forced the revision of the Treaty of San Stefano at the Berlin Congress of 1878.

Lord Beaconsfield returned from Berlin bringing back as he said "Peace with honour." But Russia, still smarting at her defeat there, determined to strike at England through her fear for India and despatched a strong military mission across Russian Turkestan to Cabul, where it arrived on the 22nd July, 1878; although the Amir Shere Ali had made every effort short of open hostilities to delay or stop it. On receipt of this news in India the Viceroy immediately demanded that the Amir, who for many years had shown a friendly feeling towards England, should receive a similar British mission—and without receiving permission for this mission to enter Afghanistan, ordered it to move forward from Peshawur on the 16th September under Sir Neville Chamberlain with Major Louis Cavagnari as his political adviser. The mission was stopped and turned back by Afghan troops just before it reached Ali-Musjid on the 22nd September. Lord Lytton promptly sent the Amir an ultimatum which expired on the 20th November, and receiving no answer by that date plunged India into the Second Afghan War.

War.

The Viceroy decided that Afghanistan was to be invaded simultaneously by three different routes, though the army in India in 1878 was in no way organised or prepared for carrying out such an ambitious programme. The Peshawur Valley Field Force concentrated at Jamrud under Sir Sam Browne, VC., advanced and seized Ali Musjid on November 20th after stiff fighting and moved slowly up the Khyber to Jellalabad which it reached on December 21st. Transport difficulties and hostile raids on the line of communication forbade any further advance until another division had been mobilised to guard its long communications, and it was not until the 14th April 1879 that Gandamak was occupied.

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The Kuram Valley Field Force under Maj.-Genl. F. S. Roberts, VC., concentrated at Thal, crossed the Kuram river on the 20th November, stormed the Peiwar Kotal on December 2nd and occupied Zabardusht Killa and Ali Khel. The Shutargardan pass was then reconnoitred, and to fulfil the orders of the Commander-in-Chief in India, a punitive expedition was sent into Khost.

In the south Quetta had been occupied in 1876, and reinforcements were now hurried up there under Maj.-Genl. M. A. S. Biddulph.

The command of all the troops in this area was given to Lt.-Genl. D. M. Stewart and whilst further reinforcements worked their way forward from their point of concentration at Multan, Biddulph advanced and seized the Khojak pass on December 12th. Kandahar was occupied on January 2nd 1879 and shortly afterwards Khelat-i-Ghilzai was occupied by Stewart whilst Biddulph marched to the Helmand at Girishk. Here also, however, commissariat difficulties rendered it impossible to maintain such a large force in the vicinity of Kandahar, so in February Biddulph marched back to India with about a division, leaving Stewart with 17,500 men and 40 guns under his command to garrison the city and guard his line of communication back to Sukkur.

The Amir, who had fled from Cabul on the 13th of December, died in Russian Turkestan on the 21st February 1879, and his son Yakub Khan, who succeeded him, finding it impossible to rule his turbulent tribesmen with three invading armies in their midst, entered into negotiations with the British, and peace was signed at Gandamak on May 20th. By the principal terms of this treaty the British obtained possession of the Khyber—and of the Kuram valley up to Ali Khel—whilst the Amir was forced to receive a permanent British mission at Cabul. Sir Louis Cavagnari was selected by the Viceroy to be the British envoy and he arrived at Cabul on the 23rd July with his escort of 25 Sabres and 50 Rifles of the "Guides" under the command of Lieut. W. P. Hamilton, VC., whilst the remainder of the troops began to withdraw to India. The war was however by no means over.

On the 3rd September the troops of the Amir mutinied and poured in a body into Cabul, clamouring for their arrears of pay. Being unsuccessful in their demands they proceeded towards the

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British Residency to try and persuade Cavagnari to interfere on their behalf. That any attack on the Residency had been premeditated seems doubtful, but when Cavagnari refused to listen to them, some of the mutineers rushed the Guides sentries who fired in self defence. This maddened the infuriated soldiers and, the townspeople joining in, the attack on the Residency began in earnest and only terminated when Cavagnari and the whole of his escort had been slaughtered after an heroic resistance.[1]

When the news of this disaster arrived at Simla it was decided that a punitive expedition under Sir F. S. Roberts, VC., should immediately proceed to Cabul by the Kuram valley route. All retrograde movements of troops were stopped, a force was at once despatched to seize the Shutargardan pass and Roberts hastened back to organise his new command. To render his force sufficiently mobile, practically all the transport animals had to be hurried down from the Khyber. Nevertheless the Cabul Field Force of approximately 6500 men and 18 guns severed its communications with India and advanced from Zargan Shahr on October 2nd. The Amir Yakub Khan, meanwhile, having lost all authority, fled from Cabul and surrendered himself to the British advanced troops at Kushi on September 27th.

Taking the Amir with him Roberts decisively defeated the Afghan Army at Charasiah on the 6th, entered Cabul on the 8th and eventually reopened communications with India through the force under Maj.-Genl. R. O. Bright which had worked its way forward by the Khyber route. The burning of villages and summary executions carried out by the troops at Cabul in retribution for the massacre of the British mission caused the tribes to rise and Roberts, after narrowly escaping disaster on the 11th and 14th December was finally besieged in Sherpur cantonments. On the approach of troops to his relief, the Ghazis attacked his fortified camp on the 23rd and were repulsed after seven hours of furious fighting. They then dispersed to their homes and there was very little fighting during the remainder of the winter. The Government of India now decided to depose Yakub Khan, to detach the province

[1] A few sowars who were out grass cutting at the time escaped, and in Bagdad in 1918 there was an old man doing "bearer" to an officer of an Indian Mountain Battery, who had been Cavagnari's "chokra" in Cabul. He had been in nearly every frontier campaign since.

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of Kandahar from the kingdom of Afghanistan and to concentrate all the Bengal troops at Cabul, relieving them at Kandahar by those from the Bombay Presidency. As soon as the handing over was complete Stewart left Kandahar on the 29th March 1880 with his division, and after defeating an Afghan army at Ahmed Khel on April 19th, reached Cabul on May 2nd and assumed command of all the troops in northern Afghanistan.

The garrison of Kandahar now consisted of two infantry brigades and a cavalry brigade, all under the command of Lt.-Genl. J. M. Primrose, and they had hardly settled into their new cantonments when information was received that Ayub Khan (a brother of the deposed Amir), who had been busy collecting an army in the neighbourhood of Herat, was advancing to the Helmand. Sher Ali, the former Afghan governor of the city of Kandahar, had been recognised by the Viceroy as the Wali of the new province of Kandahar and had been assisted to form an army by the presentation of the necessary weapons and six smooth-bore guns. On hearing of Ayub Khan's advance he immediately set out for the Helmand at the head of 2000 infantry, 1000 cavalry, with his six smooth-bores, to repulse this threatened invasion of his territory. Before doing so, however, he appealed to the Government of India to support him, and this it was decided to do in spite of the protests of the Commander-in-Chief in India.

Thus it was that the following force left Kandahar for the Helmand on July 4th under the command of Brig.-Genl. G. R. S. Burrows :—

Cavalry Brigade.—Brig.-Genl. T Nuttall (Comdg.).
"E" Battery, B. Brigade, R.H.A. (Major Blackwood).
3rd Sind Horse.
3rd Bombay Light Cavalry.

Infantry Brigade.—Brig.-Genl. G. R. S. Burrows (Comdg.).
66th Foot (Col. Galbraith).
1st Bombay Grenadiers.
30th Jacobs Rifles.
Half Company Bombay Sappers & Miners.

Approximate strength—2700, with 6 guns.

Burrows reached Girishk on the 10th to find that on the approach of Ayub Khan the troops of Sher Ali, who were already

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encamped there on the far side of the river, were untrustworthy. Arrangements were made to disarm them; but before this could be done they mutinied on the 14th and departed to join Ayub Khan after burning all the supplies collected near their camp. The Cavalry Brigade pursued, inflicted a certain number of casualties on them and captured and brought back the smooth-bore battery. But Burrows, whose supplies were now failing, found himself with his small force quite unable to hold the line of a river which was fordable everywhere and fell back on the 17th to Kushk-i-Nahkud. It was here that the six smooth-bore guns were organised into a battery under the command of Captain J. R. Slade, R.H.A. The wagons had all been burnt at Girishk and, what was to prove so disastrous later, only 50 rounds of ammunition per gun had been retained when the remainder was thrown into the Helmand.

Selected N.C.O's and men were transferred from E/B to act as Nos. 1 to the gun detachments which were composed of men of the 66th who had been through a course of gun drill. Some horses were also placed at Slade's disposal by Blackwood, and to complete the gun teams horses and harness were sent out from Kandahar, whilst Lieut. G. de la M. Faunce of the 66th and Lieuts. T. F. T. Fowle and G. S. Jones of the R.A. were attached to command the three divisions. Ayub Khan, his ranks being daily swelled by Ghazis and by Sher Ali's mutinous troops, continued his advance, crossed the Helmand at Hyderabad and reached Sangbur on the 26th.

Burrows meanwhile was not only alarmed at the reports as to the size of Ayub Khan's army, but was also fearful that it might slip past him to Maiwand and so be nearer Kandahar than he was. He accordingly decided to march to Maiwand, leaving early on the 27th, and was actually unaware that Ayub Khan was marching to the same place at the same time, when the two forces met. The orders for the march were not issued until late on the 26th and it was thus a tired force[1] that left Khushk-i-Nahkud at 7 a.m. on the following morning after a sleepless night spent in packing up a camp that had been standing for several days. The force marched in the following formation:—

[1] Most of the troops had no breakfast before moving off.

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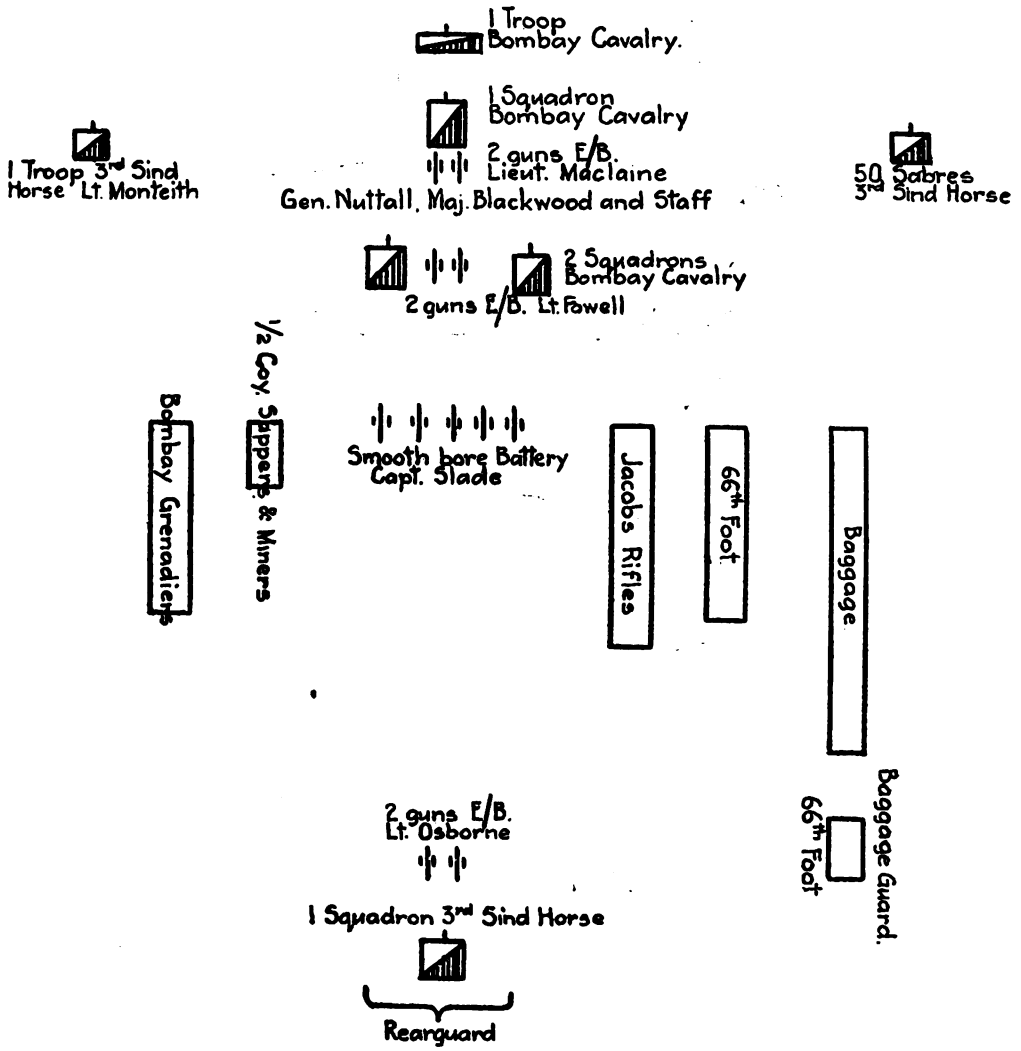

The Battle.

The mist of the early morning had foretold a day of intense heat, and the ensuing mirage rendered it very difficult to see objects clearly at greater ranges than 1500 yards. Shortly after passing Mashak the force halted to water and it was about this time that Burrows first learnt that he had been out-manœuvred and that the whole of Ayub Khan's army was marching across his front to Maiwand. Previous estimates warned him that the approximate strength of the Afghan army was 6000 infantry, 4000 cavalry, all

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regular troops, with 30 guns (six of them Armstrongs), and in addition anything up to 20,000 Ghazis as well. Nevertheless he continued his advance, though against this formidable force he was only able to oppose 1650 infantry, 490 cavalry and 12 guns (six of inferior quality manned by scratch detachments), and in addition his brigade was encumbered with a large baggage column, which required careful guarding and limited his freedom of movement. The advanced guard cavalry began to get engaged with the enemy at 10.30 a.m., shortly after the village of Mahmudabad had been passed, and Nuttall and Blackwood immediately rode forward to reconnoitre, taking with them Lieut. Fowell's division of E/B, R.H.A.[1]

The road, which now led through the village of Khig, ran along the southern bank of a deep, wide and at the time dry ravine, on the far side of which an open plain which appeared more level than it actually was, stretched northwards almost to the entrance of the Sangbur Pass. To avoid the village the leading cavalry had crossed this ravine when Maclaine, seeing a large mass of the enemy to the north, advanced quickly towards them escorted by the left flank guard and opened fire at 11.30 a.m. At this time, though the enemy's advanced troops had reached Maiwand, his artillery and cavalry were only just clearing the pass, and the noise of the guns firing must have come as a surprise to his long and straggling column. However, by the time that Nuttall and Blackwood had reached the leading squadron large masses of the enemy had become visible for the first time, stretching in a wide semi-circle from Maiwand to the north and north-west.

Nuttall ordered the cavalry to fall back and, Blackwood conforming, recalled Maclaine and ordered up Osborne's division from the rear. Meanwhile Burrows closed up the main body in Mahmudabad where he parked his baggage column, and sent on the smoothbore battery to assist the advanced guard. He shortly afterwards crossed the ravine and deployed his brigade on the northern side of it, but some way in rear of where the advanced guard was now fighting. Slade brought his battery into action on the left rear of the cavalry, and firing at a greater range found it even more difficult

[1] Lt. N. P. Fowell commanded the Right, Lt. E. G. Osborne the Centre, and Lt. H. Maclaine the Left Division in E/B. R.H.A.

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than Blackwood to find the range accurately, so that when the latter now advanced he ceased firing. Blackwood took his four guns forward for about 500 yards and again opened fire with his right protected by the 3rd Bombay Cavalry and his left by the 3rd Sind Horse. Here he was soon joined by Osborne's division which came into action on the right of the other four guns and the battery remained in this position until the end of the action.

At about 11.45 a.m. with a sudden roar many of the enemy's batteries opened and his attack developed with his regular infantry in the centre; his cavalry and Ghazis attempting to encircle the British line from the north, whilst the dismounted Ghazis, working their way down the ravine, threatened to surround the British right. Burrows quickly realised that his advanced guard was in danger of being cut off, so he moved up his infantry and deployed them into line on E/B R.H.A. as shown in Sketch "A". The cavalry being afterwards withdrawn and concentrated on his left rear, to stem the attack of the enemy horsemen from the north. The enemy's two wings, continually stretching out, advanced more quickly than his centre, which, facing the full blast of the well directed British fire, frequently halted to allow his artillery to be brought forward.

By 12.30 p.m. this constant threat of envelopment had forced Burrows to bend back both his wings, and at the same time he moved two companies of Jacob's Rifles to prolong the left of the Grenadiers. The gap thus caused in the line being filled by moving Slade with two of his smooth-bore guns up into action on the right of E/B, whilst Lieut. Jones took two more guns of the smooth-bore battery to support the right of the 66th (vide Sketch "B"). Up till now the British loss had been small, whereas the steady fire of the breech loaders had inflicted heavy loss on the enemy and had rendered his advance more cautious. Blackwood had, however, been wounded in the thigh, though he still remained in command of his battery, supporting himself on a dhooly. So for an hour the battle raged, but by 1.30 p.m. the situation had begun to change, for the enemy had by then advanced to within 800 yards of the British whilst the Afghan artillery had advanced in close support and the full effect of his 30 guns was now concentrated and directed with accuracy on to the small force opposed to them.

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Casualties now began to increase rapidly and the steady trickle of wounded to the rear also included many unwounded men who had left the firing line in search of water. Furthermore the Ghazis had worked their way down the ravine, past the British right, and were attacking the baggage guard, whilst the cavalry under Nuttall, kept concentrated and inactive in the open, had lost fairly heavily from the fire of the Afghan artillery.

Now occurred what has always been looked upon as one of the causes of the eventual disaster by those who have attempted to find an excuse for it. Burrows ordered Slade to concentrate the smooth-bore battery in the centre in an attempt to neutralise the overwhelming effect which the Afghan artillery was having on his hard-pressed line. Slade, however, found that all the ammunition had been expended, so he ordered Lieut. Fowle to take the battery to the rear to see if he could obtain any more from the ammunition park, whilst at the same time he himself took over the command of E/B from Blackwood who proceeded to the hospital to have his wound dressed.

Fowle could only obtain but few rounds when he got back, so equalising out amongst three of the guns what now remained he attempted with these to rejoin the fight, but was stopped after advancing but a short way by Ghazis who now almost completely encircled the British force (see Sketch "C"). By 2 p.m. the position had become critical especially on the left, where almost all the officers had fallen, and the withdrawal of the guns had exposed the left flank of the two companies of Jacob's Rifles. Now also, when the opposing lines were but 400 yards apart, the enemy, making skilful use of the ground, managed to bring up two guns into the firing line opposite the right of E/B. These guns gallantly served, and to some extent protected by folds in the ground, raked the front of the Grenadiers and inflicted heavy casualties.

One was soon "knocked out" by No. 4 Subdivision of E/B, but the other was still firing when at about 2.30 p.m. Ayub Khan put in his last reserve of regular troops and gave the signal for a general advance. The frontal attack was stopped by E/B firing "case shot" and the steady fire of the Grenadiers, but nothing could stop the Ghazi rush which followed and which was directed against both flanks, and across the front of E/B towards the right of the

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Grenadiers. The 66th, who up till now had suffered comparatively lightly, beat back the rush against the southern flank, but the attack against the northern flank struck the two companies of Jacob's Rifles and these having reached the limit of their endurance, broke and were driven in on the Grenadiers. The latter regiment attempted to "form square," but being caught by the rush of fugitives in the act of forming, lost all military formation, and the Ghazis dashing in amongst the confused and exhausted soldiers completed the disaster which had now overcome the left wing.

Lieut. Fowell had been wounded a short while previously and Slade was controlling the fire of the right division when he became aware of the events taking place on his left. He just had time to fire a round of "case" and order up the teams before the Ghazis swept into the battery position. Maclaine probably never heard the order to limber up, and leaving it till too late both his guns were captured and most of the men of his detachments slain.

The leaders of No. 2 gun team were shot down when limbering up, and it was at this moment that Sgt. P. Mullane, the No. 1, by his coolness and courage not only managed to get his gun away but also picked up his lead driver[1] who had received a ghastly wound and placed him on a limber; thus winning the VC. Lieut. Osborne, as soon as he was mounted, charged straight at the onrushing foe, cut down several who were attacking a British officer, thereby saving his life, and was last seen fighting desperately near the two lost guns. There is no doubt that by his very gallant conduct he had drawn the enemy's attention on to himself, thereby giving his own guns a better chance to get away. Slade galloped clear of the *melée* and then halted to reorganise, and finding that he had lost about 50 horses was forced to abandon three wagons which had been badly shattered by shell fire.

Burrows, as soon as he saw the disaster that had overcome his left wing ordered Nuttall to charge and if possible clear the front and flank of the Grenadiers to enable them to reform. The cavalry, however, partially disorganised by the casualties amongst the horses, and the Sowars to some extent demoralised by the panic which had set in before their eyes, charged but half-heartedly and then getting entangled amongst the fugitives who were now making

[1] Driver Pickwell Istead.

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their way towards Mahmudabad, could not be rallied until they had reached the vicinity of that village.

On the retirement of E/B the half company of Sappers and Miners had fought heroically till overwhelmed, when the Ghazis rushing through the gap thus caused in the line, rolled up the right wing from the left, driving the 66th and a crowd of disorganised and bewildered native troops in the direction of Khig. The force was thus split into two and Burrows giving up all hope of being able to rally the remnants of his left wing, galloped towards the 66th in a vain endeavour to change the direction of their retreat towards Mahmudabad, but with scant success. For the battalion, still fighting hard, crossed the ravine and sold its life dearly in the village of Khig; the survivors, two officers and eight men, being finally overpowered and slain just south of the village.

Burrows, with such men as he could in the confusion persuade to follow him, made his way back through Mahmudabad and joined the remainder of his force later in the afternoon. When the line broke Blackwood was near the Hospital, and realising the gravity of the situation he gave his field glasses to a Jemadar[1] of the cavalry and ordered him to ride immediately to Kandahar to warn Primrose of the fate that had overcome the brigade, and to produce the field glasses as a token of the authenticity of the message.

He then appears to have made his way back to the firing line and to have joined the 66th, for his dead body was found in the garden where the battalion made its last stand, by the force that visited the battlefield after the battle of Kandahar.

Slade retired with E/B after he had reorganised, and, picking up the smooth-bore battery en route, came into action south of the ravine near Mahmudabad to cover the retreat. Here he was joined by Nuttall with such of the cavalry as he had been able to rally, and here also some of the native troops were rallied. But many, totally overcome by thirst and oblivious of all that was happening around them, straggled past the guns and became engulfed in the stream of fugitive transport drivers and followers who, witnessing the success of the Ghazi rush, had set out on a wild stampede for Kandahar.

[1] "The Second Afghan War," by Hanna. The Jemadar arrived at Kandahar with the first news of the disaster, being shortly followed by Sher Ali who had left the battle early.

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The enemy's artillery soon picked up the range and when his cavalry began to work its way round the flanks, Nuttall ordered the battery to fall back.

Slade, who had picked up on his carriages all the wounded that they could carry, retired and, coming into action twice on the way, finally reached a position about three miles from Mahmudabad. Here a halt was called, as the pursuit had slackened when the Ghazis had found the British baggage and turned to looting it.

The cavalry went back towards the battlefield to see if they could help on any survivors, and amongst others were able to assist Burrows in his retreat with those men of the right wing that he had prevailed upon to follow him. Burrows reached the guns at 3.30 p.m., and since it now appeared that there could be but few other survivors, the retreat was resumed, the cavalry going to Karez-i-Atta to water, leaving the battery as the only unit which still preserved its military formation to act as rear-guard to the exhausted remnants of the force.

Slade sent on Maclaine with two guns and the smooth-bore battery whilst he remained with the other two guns to bring up the rear and shepherd on the fugitives.

The Retreat.

Unfortunately many of these had taken the direct route to Kandahar via Sinjiri, and their sufferings during this 30 mile march without water must have been ghastly in the extreme.

The main body had, however, been deflected along the track to Hauz-i-Madat in the hope of water being found there, and Slade following the same route, by coming into action often and using his gunners armed with battery carbines as riflemen[1] was able to safeguard the rear until night covered the miseries of the struggling column.

Hauz-i-Madat was reached at midnight but scarcely any water was found there so the fugitives drifted on along the track to Ashu-Khan, all efforts made by Burrows to sort out the men into their own units or to get them into some military formation having failed. The cavalry rejoined the column here and Nuttall, leaving

[1] It was in this way and at this time that Gunner Collis, E/B. R.H.A., won the V.C. By drawing fire on to himself he enabled many wounded and stragglers to get away.

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some volunteers to assist Slade in bringing on the stragglers, pushed on with the bulk of his brigade to act as advanced guard. But the sowars had now also reached the limit beyond which discipline could not be upheld and they gradually abandoned their formation, left the column and pushed on to Ashu-Khan.

All through the night the retreat continued and the lack of water, telling fearfully on the now exhausted horses, rendered them almost incapable of moving the guns. So that at various stages after passing Hauz-i-Madat it was found necessary to abandon the three remaining wagons of the R.H.A., the spare gun carriage and store limber wagon and also five of the smooth bore guns, whilst the horses and bullocks thus made available were used to assist the struggling teams still pulling the guns of E/B or the limbers still loaded with their human freight.[1] The rear of the column struggled into Ashu-Khan at about 4.30 a.m. just after dawn and Slade found that with the coming of daylight his troubles increased, for the rear was now almost continuously under fire and the attacks of the tribesmen grew bolder as the weakness of the force opposed to them became evident. Furthermore, as the heat increased, many who had striven thus far "dazed, footsore, dying of thirst, with a look of bewildered agony on their swollen faces and bloodshot eyes" [2] now fell exhausted and were butchered where they lay.

Eventually a plentiful supply of water was found at Sinjiri which was reached at about 7 a.m., and here Burrows was able to effect some reorganisation in his weary troops who had marched 45 miles in 24 hours and fought a battle in addition. The revivifying effect of the water was quickly apparent, and what had been a disorganised rabble an hour previously, quickly became again a military force, units reformed rapidly and when the retreat was continued Burrows was able to do so with both a small advanced guard and rear guard.

The small relieving force sent out from Kandahar under Brig.-Genl. Brooke was met at Kokeran at 9.30 a.m., and in easy stages and slowly Burrows with the remnants of his brigade was escorted to Kandahar which was reached at 2.30 p.m.

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[1] Lt. Maclaine and Bdr. Lowe of E/B. were surrounded and made prisoners during the night, whilst searching for water in a village.

[2] *The Times*, 17th September, 1880.

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So ended the Battle of Maiwand. Troops have rarely been so severely tested as in this battle, and that they at last gave way was the direct result of the faulty tactics of their general, who exposed his small force to a numerically overwhelming enemy in the heat of an Afghan summer without food or water.

Kandahar was now besieged, necessitating the famous march of Sir F. S. Roberts, VC., with a picked force, from Cabul to its relief which terminated in the Battle of Kandahar on September 1st, when Ayub Khan was totally defeated and his army scattered. In the Afghan camp was found the still warm body of poor Maclaine with his throat cut; whilst amongst the spoils were the two guns which had been lost by E/B at Maiwand.[1] The war was brought to a close by the recognition of Abdur Rahman as Amir and the evacuation of the country by the British soon afterwards.

Remarks.

For their gallantry on this occasion the men of E/B were rewarded with two VC's and eight D.C.M's, while on Slade, the only officer left unwounded, was conferred the C.B., and rarely can this honour have been more richly earned. For, taking command of the battery in the crisis of the fight, he had kept his head when the line broke, and got most of his guns away. And in the long retreat afterwards many of the wounded, both officers and men, owed their lives to his tenacity in refusing to allow them to be abandoned to a pitiless foe; whilst many an exhausted man must have plucked up the energy to struggle on towards Kandahar inspired by his courage and example.

E/B R.H.A. was raised in 1825 as the 3rd Troop of the 1st Brigade, Bengal Horse Artillery, and when the 2nd Afghan War broke out was stationed at Kirkee. On the 28th January 1880 the battery marched from Kirkee en route for Bombay, where it arrived on February 3rd. Leaving here on board the s.s. *Culna* on the 10th it arrived at Karachi on 13th and after a short stay here proceeded by rail to Sibi, and joining the Kandahar Field Force at Naribase on the 22nd, marched via the Bolan and Khojak passes to Kandahar which was reached on the 10th April. After the Battle of Kandahar the battery under the command of Major J. A. Tillard,

[1] It would be interesting to know where these two guns are now. They were sent to Woolwich.

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who had joined it on the 30th August, marched from Kandahar on the 8th October and reached Jacobabad on the 1st November, where it was marked out for a most signal honour.

The Viceroy, Lord Ripon, had arrived in Jacobabad on the 18th, and on the next day E/B R.H.A. fired the salute when he left after paying a state visit to the Khan of Khelat. The Viceroy stopped his carriage and when the salute was over addressed the battery as follows:—

"Major Tillard, as I pass this battery, I cannot resist the impulse which prompts me to address a few words to you, your officers and men, in order to express my deep sense of the gallant services of the battery at the Battle of Maiwand; when in the hour of difficulty and danger they firmly upheld the reputation of the distinguished corps to which they belong and when, as I may say without exaggeration, they even wreathed fresh laurels round the guns of the Royal Artillery.

It is not alone in the hour of success and in the triumph of victory that the qualities of true soldiers are displayed. They are called for no less when the tide of battle runs against them, in the stubborn resistance and perilous retreat; such occasions afford special opportunities for the display, not only of that valour and discipline which are common to all British troops, but also of the noble qualities of pity and self-sacrifice, and you officers and men may be proud to recollect in after days how many of the survivors of the 27th July owe their lives to your exertions.

Sir, I rejoice to feel that the honour of Her Majesty's Arms will ever be safe in weal and woe in the hands of this battery, and I esteem myself very fortunate to have had the opportunity of seeing them."

On the 3rd December the battery arrived at Karachi by train and embarking on s.s *Scindia* on the 8th reached Bombay on the 10th, where on the 14th the whole of the men were entertained to dinner in a big marquee by the citizens of Bombay, when speeches referring to the distinguished part that the battery had played in the battle of Maiwand were made by the Governor, the Commander-in-Chief and Lieut.-Genl. Olpherts, and the evening finished by the men giving hearty cheers for the 66th Regiment and the Bombay Grenadiers.

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The battery left Bombay on the 17th December and spending the day with the 66th at Khandalla on the 23rd reached Kirkee on the 27th, having been away nearly a year.

When the despatches were published the following tributes to the conduct of the battery at Maiwand were made known :—

The Adj.-General's report to the Government of India, 25th September, 1880.

"It is his Excellency's pleasing duty to bring to the notice of the Governor General in Council the admirable behaviour of the officers and men of E/B R.H.A. who fought most gallantly and suffered severely. . . . . The artillery maintained their military formation and morale during the retreat."

General Burrows's report to the A.A.G., Kandahar Field Force, 30th August, 1880.

"Of the conduct of the troops generally I have already spoken, but I wish to bring the Artillery to special notice, their behaviour was admirable, exposed to a heavy fire they served their guns coolly and steadily as on parade, and when the guns were rushed they fought the Ghazis with hand-spikes and sponge-rods."

General Nuttall's report to the Brigade Major, Kandahar Field Force, 30th August, 1880.

"The guns of E/B R.H.A. under their officers, and those of the Smooth Bore Battery under Captain Slade were most admirably and steadily served and nothing could equal, and certainly never excel, the gallant, cool, and collected bearing of officers and men during the action."

The casualties at Maiwand are shown in the following table, all the missing being counted as dead :—

Unit.	*Approximate Strength before the Battle.*	*Casualties during the Battle and Retreat.*		*Total.*
		Killed.	*Wounded.*	
Native Cavalry	576	41	23	64
E/B. R.H.A.	189	21	13	34
Sappers & Miners	45	18	7	25
66th Foot	516	286	32	318
Native Infantry	1404	604	91	695
Total	2730	970	166	1136

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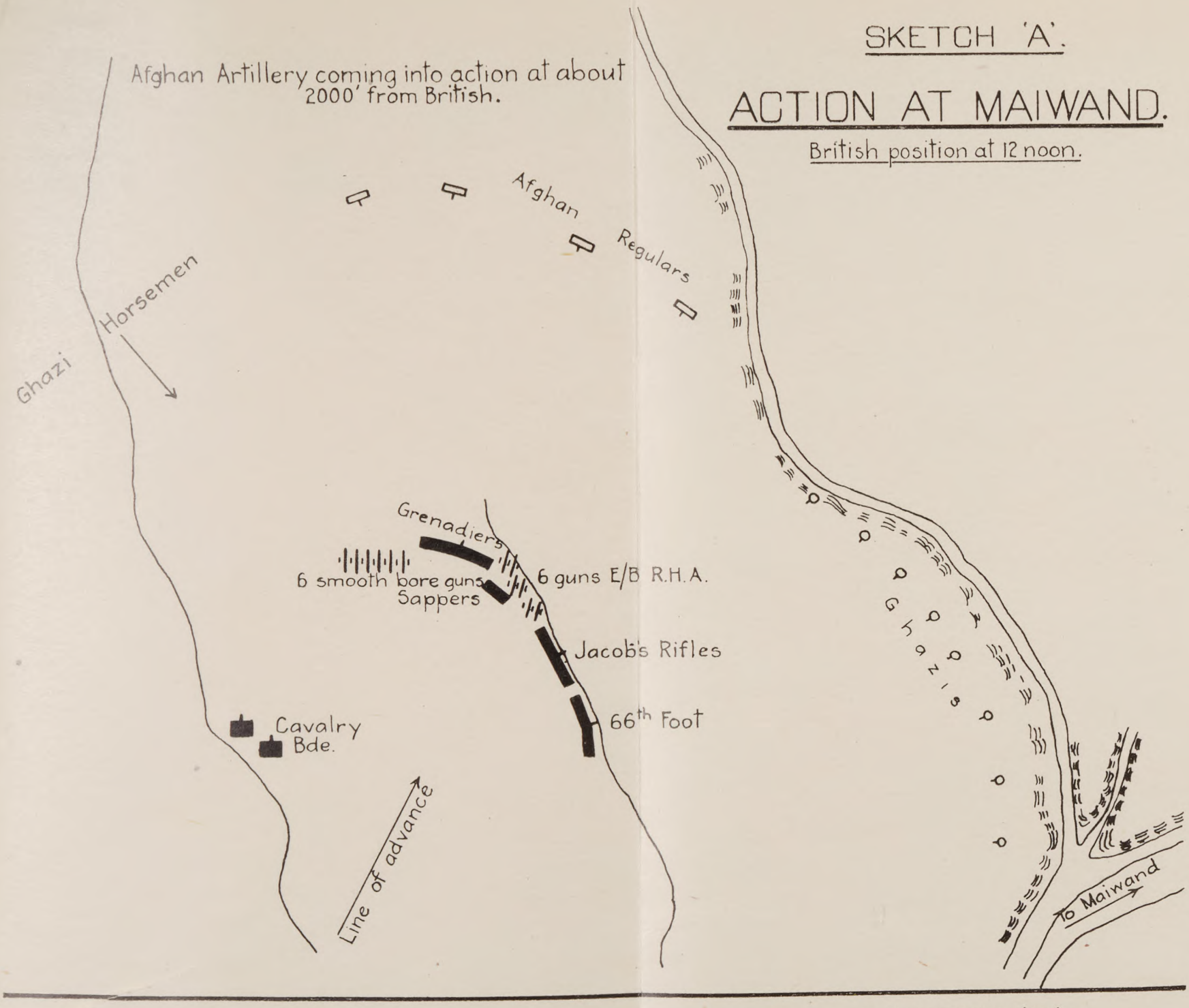
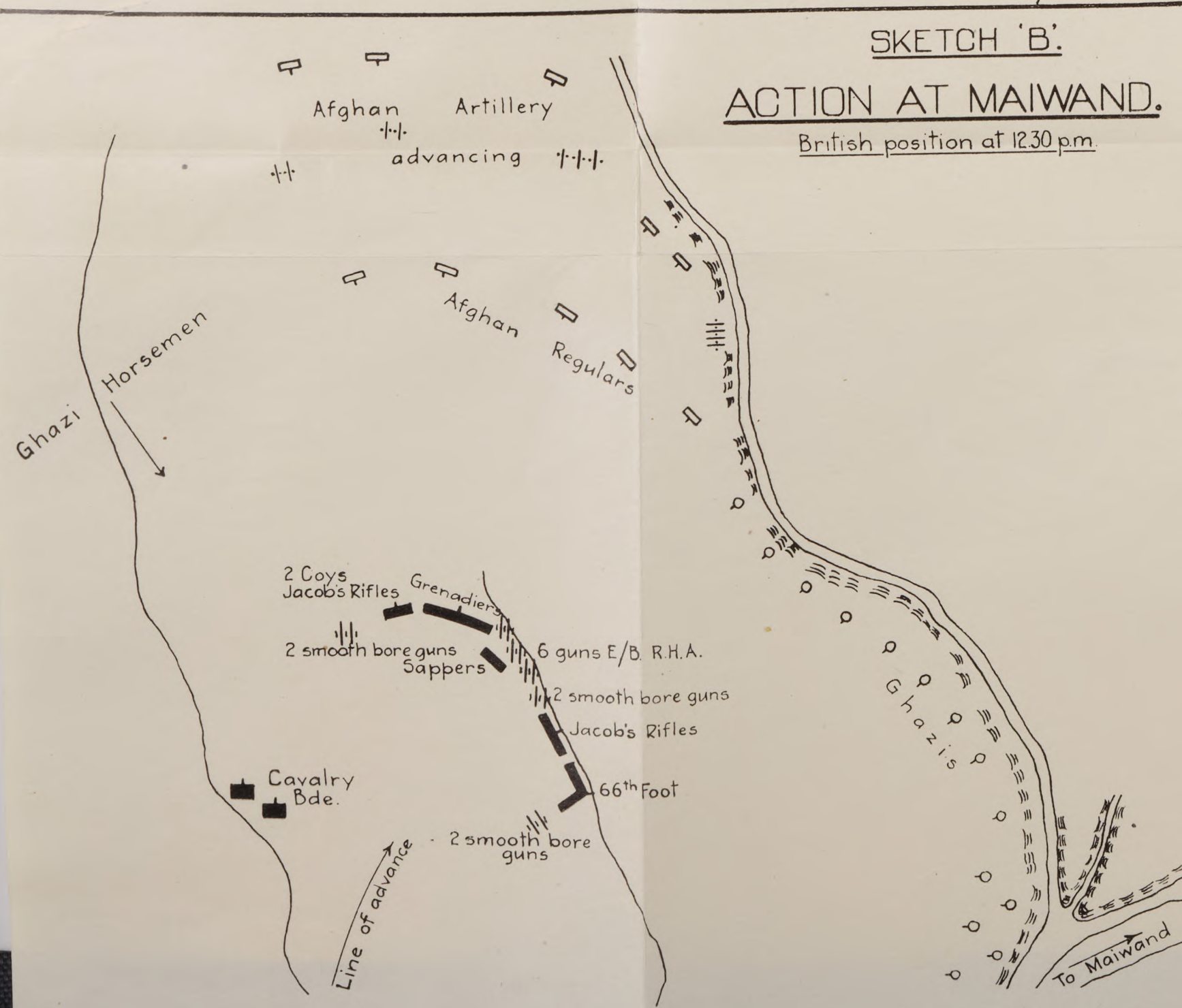
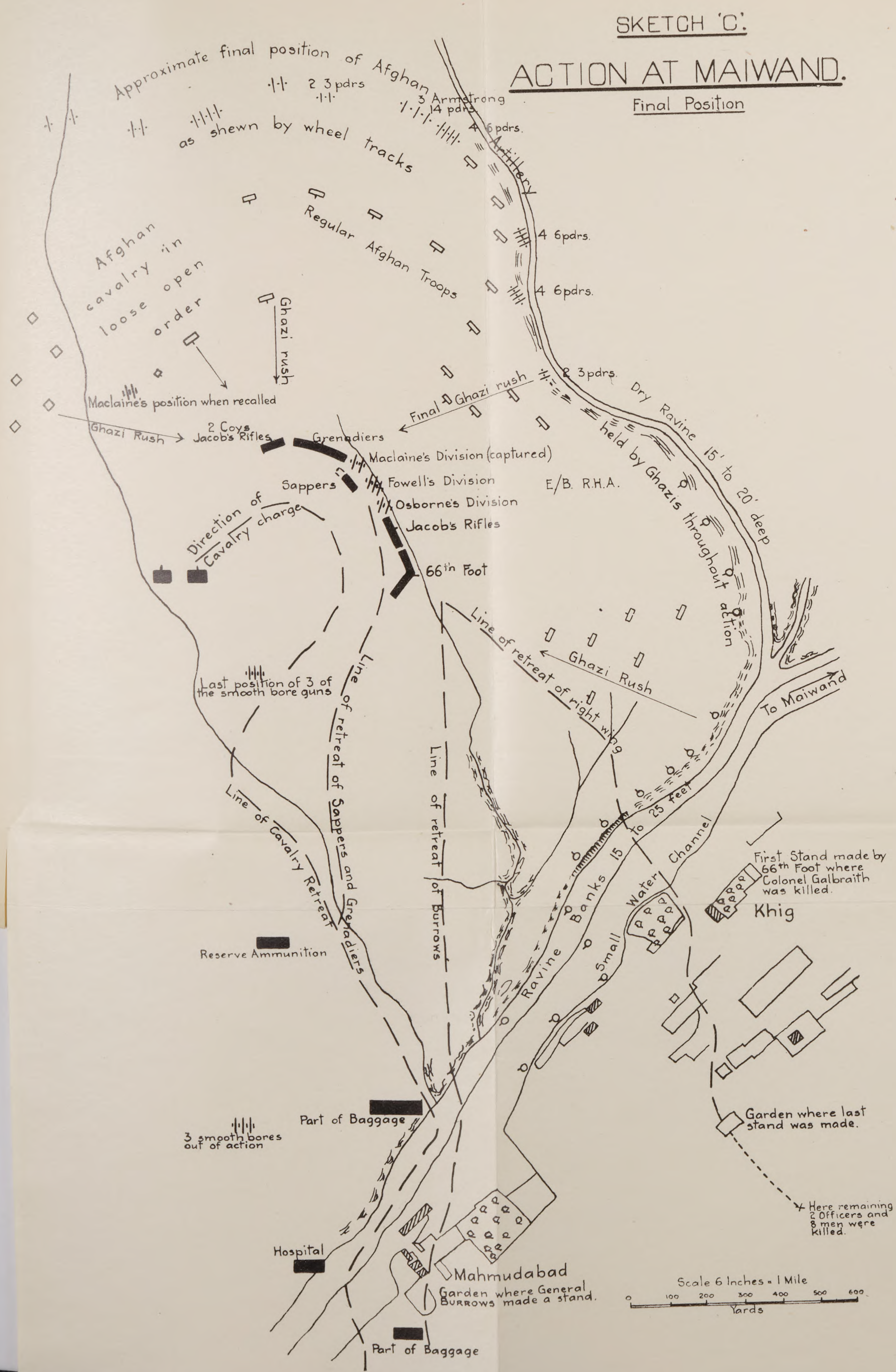
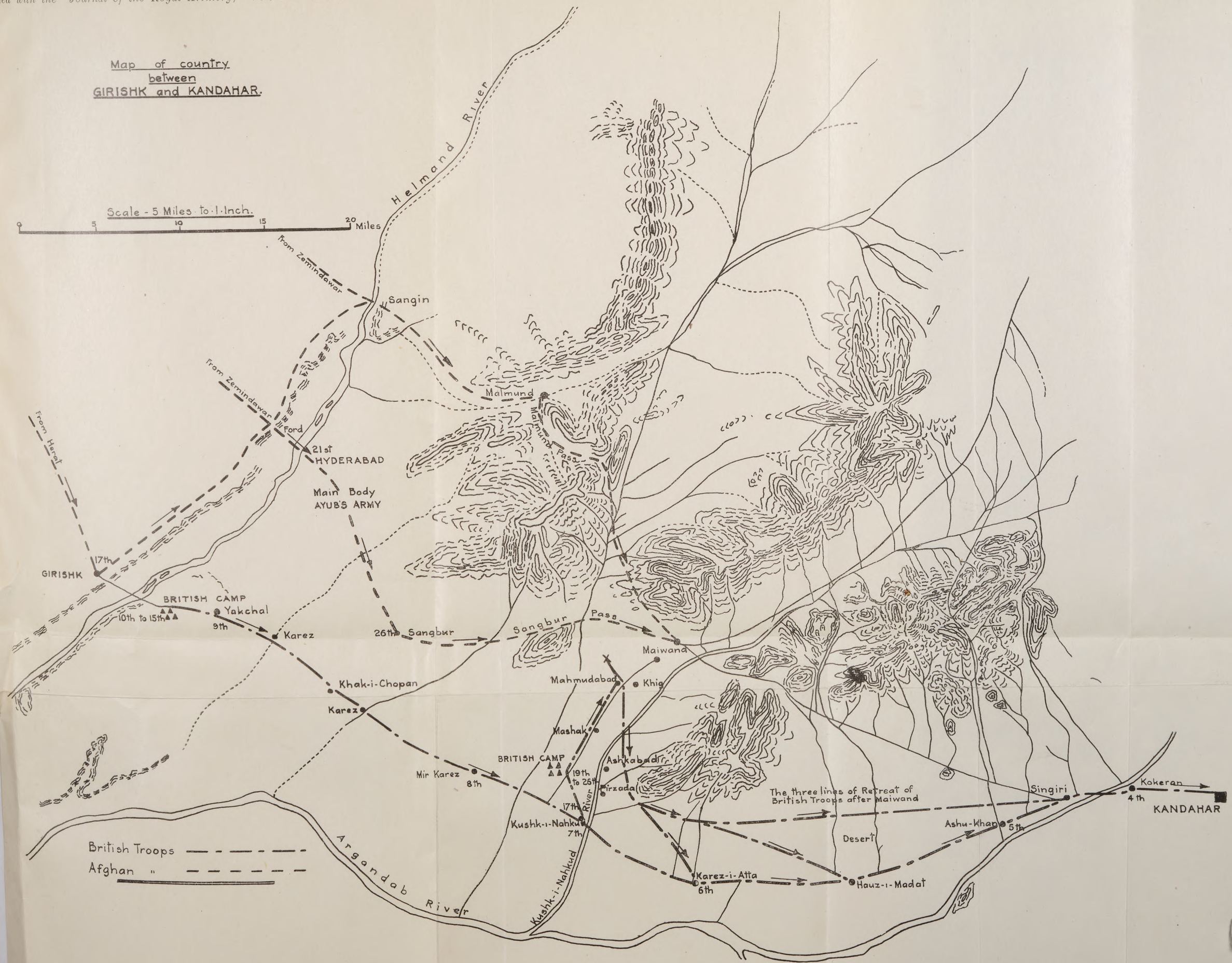

SKETCH 'A'.
ACTION AT MAIWAND.
British position at 12 noon.
Afghan Artillery coming into action at about 2000' from British.
Afghan Regulars
Horsemen
Ghazi
Grenadiers
6 smooth bore guns
Sappers
6 guns E/B R.H.A.
Jacob's Rifles
66th Foot
Cavalry Bde.
Line of advance
Ghazis
To Maiwand


SKETCH 'B'.
ACTION AT MAIWAND.
British position at 12.30 p.m.
Afghan Artillery advancing
Afghan Regulars
Horsemen
Ghazi
2 Coys Jacob's Rifles
Grenadiers
2 smooth bore guns
Sappers
6 guns E/B. R.H.A.
2 smooth bore guns
Jacob's Rifles
66th Foot
Cavalry Bde.
2 smooth bore guns
Line of advance
Ghazis
To Maiwand


SKETCH 'C'.
ACTION AT MAIWAND.
Final Position
Approximate final position of Afghan as shewn by wheel tracks
2 3pdrs
3 Armstrong 14 pdrs.
4 6pdrs.
Artillery
4 6pdrs.
4 6pdrs.
Regular Afghan Troops
Afghan cavalry in loose open order
Ghazi rush
Final Ghazi rush
2 3pdrs.
Dry Ravine 15' to 20' deep
held by Ghazis throughout action
Maclaine's position when recalled
Ghazi Rush
2 Coys Jacob's Rifles
Grenadiers
Maclaine's Division (captured)
Sappers
Fowell's Division
E/B. R.H.A.
Osborne's Division
Jacob's Rifles
Direction of Cavalry charge
66th Foot
Line of retreat of right wing
Ghazi Rush
Last position of 3 of the smooth bore guns
Line of retreat of Sappers and Grenadiers
Line of retreat of Burrows
To Maiwand
Line of Cavalry Retreat
Banks 15 to 25 feet
Water Channel
First Stand made by 66th Foot where Colonel Galbraith was killed.
Khig
Small Ravine
Reserve Ammunition
Part of Baggage
3 smooth bores out of action
Garden where last stand was made.
Here remaining 2 Officers and 8 men were killed.
Hospital
Mahmudabad
Garden where General Burrows made a stand.
Part of Baggage
Scale 6 Inches = 1 Mile
0 100 200 300 400 500 600
Yards


Map of country
between
GIRISHK and KANDAHAR.
Scale - 5 Miles to 1 Inch.
0
5
10
15
20 Miles
Helmand River
From Zemindawar
Sangin
From Zemindawar
Ford
21st
HYDERABAD
Main Body
AYUB'S ARMY
From Herat
17th
GIRISHK
BRITISH CAMP
10th to 15th
Yakchal
9th
Karez
26th
Sangbur
Sangbur Pass
Maiwand
Khak-i-Chopan
Karez
Mahmudabad
Khig
Mashak
BRITISH CAMP
19th to 26th
Ashkabad
Mir Karez
8th
Pirzada
17th
Kushk-i-Nahkud
7th
Kushk-i-Nahkud River
Malmund
Malmund Pass
The three lines of Retreat of British Troops after Maiwand
Desert
Karez-i-Atta
6th
Hauz-i-Madat
Ashu-Khan
5th
Singiri
Kokeran
4th
KANDAHAR
Argandab River
British Troops
Afghan "

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21 British officers were killed and 8 wounded. A few of the missing were traced and released by the British force which visited the battlefield after the battle of Kandahar.

The attached key plate has been prepared with the help of Mr. Seville and Mr. Williams and it is hoped that all who have the print will purchase a copy and so help to perpetuate the names of a few of the men who so gallantly upheld the fair name of the Regiment on the fatal 27th July, 1880.[1]

[1] These can be obtained from Messrs. Gale & Polden of Aldershot, suitably framed, for 4/6 each.

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TRAINING AND ADMINISTRATION IN A MECHANISED UNIT.

By Lieut. H. G. Freeman, R.A.

Note.—*As this article is by an officer of the Mechanical Transport Branch, Military College of Science, it is considered advisable to state that the opinions expressed are the personal views of the author.*

MUCH has been written on the developments of mechanisation in the service, chiefly describing new types of machines, and their suitability for various tasks. Great strides have been made, too, in the invention of new vehicles and the improvement of existing designs; yet little has been heard of another problem, which has grown up with this new departure, namely that of training the personnel who have to handle these machines. However good a design is produced, or however efficient a machine is made, it is of little avail, if the user of the vehicle fails to handle or maintain it correctly. Unless the most careful attention is paid to economical methods of maintaining M.T. vehicles, the cost of mechanisation can and will become appalling. The mechanisation of Royal Artillery Brigades has been increased very considerably of recent years, with the result that there are many regimental officers to-day who are being confronted with a variety of new problems and difficulties. The Regiment has created a very high standard of horsemastership, and it is a rare occurrence to see an ill conditioned gun or wagon team turned out. This result has been achieved firstly by the good training of personnel, secondly by the correct inspection and maintenance of the animals, and lastly by administration. Let us deal with the application of these principles to a mechanised battery or brigade. Taking the first, namely the training of personnel.

Training of Personnel.

Officers.

An officer on first appointment from the Shop, if posted to a horsed unit, gradually acquires a knowledge of horsemastership,

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encouraged by his battery commander, and usually the other battery officers, and at the same time takes a pride in its acquisition. A normal man's love of animals helps him to a large extent. The ground work is already existing, therefore, upon which to build up his knowledge of this part of his profession. Should he be posted to a mechanised battery, the problem is a very different one. There is no definite standard of regimental mechanical efficiency to live up to, to encourage him to increase his knowledge of his vehicles. Until he has undergone a mechanical traction course, he probably does not know the first essentials of the efficient maintenance of vehicles. There is no "mechanical sense" to form any sort of ground work, and so the training required is long, and the results can only be seen after considerable experience in a mechanised unit under the supervision of a senior officer. An idea is prevalent in some quarters, that if an officer owns a car, or can drive one, that after a very short training, possibly in his own unit, he will be fit to take charge of the vehicles in his section. This is very far from being the case, as an inspection of the cars in front of any mess will show. The sensation of controlling a powerful car at speed appeals to many young officers, and their ability in that direction is usually good. The garages and service stations which cover the countryside do not encourage any interest in vehicle maintenance, whilst a breakdown fails to cause much serious inconvenience (except financial) owing to the great number of cars one is bound to meet on the road, and someone in one of them usually offers assistance.

In the army, a mechanised unit might be called upon to serve in any part of the world, and there will be no such generous supplies of maintenance and help available on service. A knowledge of vehicle inspection, care and maintenance, is amongst the first essentials for every officer of a mechanised unit, as well as an ability to diagnose simple breakdowns. Driving ability is useful, but is of much less importance. They are dull subjects to many, and proficiency in inspection can only be obtained after considerable practice and experience. In my opinion, a regimental officer cannot be expected to have sufficient mechanical knowledge to carry out a detailed inspection for wear, etc., that is the province of the Ordnance Mechanical Engineer, but he should be in a position to sentence a defective vehicle in his section.

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By sentencing is meant, that when a defect is reported to, or detected by him, he should be able to state whether the vehicle could continue running, or that the repair could be made by the driver, or else that the advice of the technical officer R.A.O.C. should be sought. It would be of great advantage if all young officers passed out of the Shop with a good elementary knowledge of the first principles of mechanical engineering as applied to motor vehicles, besides a practical knowledge of care and maintenance. The driving instruction could be left till they joined their units.

Finally, every section commander should know the correct procedure in the case of a road accident, the elements of M.T. account keeping, and store accounting. They should also be conversant with the methods of getting vehicles out of difficulties when ditched. This is taught to certain M.T. courses held at the Military College of Science, but all officers should acquire this knowledge.

Training of senior officers and advanced courses.

It is not proposed to go into detail as regards the advanced training of officers in mechanical transport, but it is most essential that everyone undergoing an advanced course should have the backing of a good, sound practical experience, both in workshops and with vehicles, before delving too deeply into the theoretical side of the subject. Without such a backing, it is easy to make grave errors, and to be out of sympathy with the troubles of the man who has to run the machine in the unit. Senior officers who have had no mechanical training, have neither the inclination, nor the time, to study the details of the construction of their vehicles, or their detailed care and maintenance, on a course lasting several months. Their needs could best be met by a short course lasting about a fortnight, consisting of M.T. administration, organisation, and demonstration of inspections, and care and maintenance operations.

Other Ranks.

N.C.O's.

One difficulty the Royal Artillery has to contend with at the moment, is the lack of any trained N.C.O's to form a link between the trained section commander and the driver I.C. Few Nos. 1

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have had any form of proper M.T. training. It would be possible, as has been proved on the M.T. courses held for senior N.C.O's, in a short time to train them to carry out simple mechanical inspections, on the lines of horse supervision. The taking over of fresh vehicles, and the preparation of the sub-section for parade, as well as the running of "mechanical stables," are all subjects which can be taught comparatively quickly. These, together with a knowledge of elementary M.T. administration and bookkeeping, such as the maintenance of running accounts for mileage and expendable stores by means of log sheets, should enable a N.C.O. in a mechanised unit to run the transport side of his sub-section efficiently. Driving is another matter. It is of far less importance to senior N.C.O's than the other subjects. The time spent on all such training could be very considerably reduced, if the N.C.O. had been a qualified driver I.C. earlier in his service, there is but little possibility however, of there being any supply of such N.C.O's at the moment. A sergeant, of course, should be able to take charge of a column of M.T. vehicles, and be in a position to deal with any emergencies which may arise, such as road accidents, and machines becoming bogged, etc.

Drivers.

The training of the driver I.C. is a big problem at the present time. Endeavours have been made to set as high a standard as possible for all Royal Artillery drivers, but there is a feeling amongst some officers that so long as a man can drive a vehicle fairly well, which in their opinion consists of changing gear without undue noise, and avoiding accidents, he is of sufficient standard to become a classified driver. This is enough for other corps perhaps, where conditions are different, and the bulk of the personnel of units have received various grades of M.T. training, and can watch the work of the drivers closely. With the Regiment, owing to the small establishment of drivers, a man is called upon to take entire charge of a machine, costing hundreds of pounds, sometimes thousands, without much supervision. The bulk of the Royal Artillery drivers I.C. are trained at the Military College of Science, and join there on completion of their training at the R.A. Depot, for a three months' course in M.T. If successful at the end of the course,

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they become drivers I.C. Class III. They are all volunteers, carefully selected and trained. There is another source of supply, namely through the Command Testing Boards. The men are trained in their own units, and then tested by the boards. In my opinion, this method seems to be very unsatisfactory at the moment, as there are no trained instructors in units, nor is there any handbook to work from, whilst the standards set by boards differ greatly. It must be remembered that the driver is only a gunner, and often a young soldier as well, and unless he is carefully supervised, he will either relapse into bad mechanical habits, or in an excess of enthusiasm, attempt repair work entirely beyond his capacity, and so cause expensive damage. Army Order 25 of 1926 lays down the tests for the various grades of drivers, which, if faithfully carried out, should produce a reliable and properly qualified man. Too high a standard cannot be set, for, apart from the vital considerations of economy, it is merely increasing the perils of the road to allow an inefficient man to drive.

Tests and standards for Drivers I.C.

As many seem to be in doubt as to what a driver should be taught, the following has been tried and has proved successful as a general line of instruction for a man being trained for class III.

Driving. The standard set for Royal Artillery drivers demands that he should be able to drive proficiently both a wheeled and a cross-country vehicle, although the Army Order asks for one only. A cross-country machine covers either the dragon, kegresse, or six-wheel vehicle according to the equipment of his unit. Proficient driving should be tested under :—

(a) Gear changing on the level, on hills, and at various speeds.

(b) Traffic driving. This test should give each candidate at least 15 to 20 minutes driving in the thickest traffic which can be found.

(c) Manœuvring a vehicle in a confined space, such as backing into garage, as well as driving between running boards, or, in other words, two planks laid in a road, just a little further apart than the width of the vehicle, to test a man's ability to drive in a narrow street. Also he must be able to reverse easily in a narrow road. This set of tests is

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most important, besides being one of the best gauges of a driver's ability, it will save many damaged walls and garage entrances.

(d) Driving in column and driving at night.

(e) With cross country vehicles, in addition to the above, he should be able to drive across country with proper vehicle sympathy, and to negotiate obstacles. Those who are destined as gun tractor drivers should be tested in driving between posts with a gun and limber, as well as in limbering up. Traffic driving with dragons should be avoided, however, for when they are being driven through streets filled with traffic, special arrangements are always necessary for clearing the way.

All these tests should be made as stiff as possible, and a man ought to score at least 85% to pass.

Maintenance. This part of his training is at once the most important and the most difficult to teach. It has been laid down in the syllabus of training for the driver I.C. Class III that, he must know the engine and the vehicle lubrication systems of both his machines thoroughly, and, at the same time be able to maintain them correctly. He must be able to look after the cooling systems of his two vehicles. Under this general heading comes the much discussed question of "repairs." Taking first the magneto. This is an instrument best left alone by the driver as much as possible, but there are certain simple tests he must carry out, such as cleaning out the distributor block, fitting new carbon brushes, and testing the contact breaker points for gap. He should have a general idea of the principles of retiming, as well as being able to trace simple ignition defects, from the plugs back to the magneto. On arrival there, after he has examined the points of the contact breaker, and also the distributor, his work should cease, and an artificer's inspection begin.

The carburettor is simpler, and less liable to damage, besides being easier to understand. He should be able to clean it out, and, if necessary refit it correctly on the induction pipe. A few simple faults, causes, and remedies should be known as well. On the engine itself, he should certainly be able to adjust tappits correctly, and remove, grind in and refit a valve and spring, etc. The remain-

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ing repairs he can carry out, are such things as fitting new hose connections, fan belts, etc. With the transmission, he should be able to adjust the clutch, as well as remedy fierceness or slip. Wheels and tyres, whether pneumatic or solid, should be correctly maintained. The above is only a very general idea of his limitations as regards repairs, but should serve as a guide. He must have a good knowledge of the care of bodywork and equipment, especially the electric lighting and starting set, but no repair beyond this. He should be tested in the maintenance section of his training both practically and by oral questions. A short written paper is useful at times, especially for record purposes, but in my opinion it is not essential.

As regards what is called by some, the "theoretical" side of his training, it has been laid down that he should have a good general idea of the functioning of the various parts of the vehicle, including the engine, carburettor, magneto, or ignition system, clutch, gears and transmission, wheels, tyres, lighting and starting set. The following are good tests:—

Firstly a practical lubrication test on each of the two vehicles, including the naming and identification of various selected lubrication points on the vehicles.

Secondly, adjusting tappits, and removing and replacing a valve. Thirdly, identifying and naming five or six parts of the engine and chassis, and a few simple questions on the care of lighting sets and starting equipment. Lastly, a number of oral questions, at least six, on care and maintenance, engine and vehicle lubrication systems, the simple functioning of various components, and the correct procedure in the case of a traffic accident. The man should gain at least 75% marks to qualify. Three months' training is required to fit a man to pass such a test as this, but the results should more than justify the time spent.

Inspection and Maintenance of Vehicles.

Many in horse drawn units are under the impression that with the advent of mechanisation, the routine work in the battery is reduced. This is far from being the case. It is true that when the machines are finally housed in their garages, they can be left for some days without anyone troubling about them, but whilst they

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are running, they demand the closest attention and supervision. This work falls into three sections, each distinct from the other. They are as follows :—

(a) The driver's and the N.C.O. in charge of vehicles' section.
(b) The battery officer's section.
(c) The brigade technical officer's section.

To deal with (a) firstly; on a normal running day, the driver has to carry out three inspections, namely, one which should be made before the vehicle moves off onto the parade ground, the second should be made at a convenient halt or halts, according to the length of the journey and the third immediately before garaging the machine for the night. A definite "drill" of some form or other, should be laid down for these inspections, and the following drills have been used successfully :—

1. *Before starting off daily.*

   1. Check petrol, water and oil both in the vehicle, and in the spare tins.
   2. See that there is a complete and serviceable tool kit on the machine.
   3. Check the oil levels in the gear box and differential.
   4. Make a note of the reading of the mileage recorder.
   5. Verify that the road registration licence, if issued, and the number plates are correct.
   6. Test the lighting set, and all controls.

All this should be done before the driver attempts to start the engine.

2. *At each halt.*

   1. Examine the vehicle for loose nuts and bolts, in some such order as given in para. (3) 1. below; and the tyres for cuts, stones and inflation.
   2. If the halt is in the middle of a long journey, and is for more than half an hour, lubrication of parts, in the order given below, should be carried out.

3. *Before parking the vehicle in garage after the last parade of the day.*

   1. Lubricate the vehicle in accordance with the vehicle's

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lubrication chart, and to be carried out in the following order :—

(a) Springs and spring shackles.
(b) Steering gear.
(c) Clutch and transmission, including track carrying mechanism if fitted.
(d) Brakes and braking gear.
(e) Wheels, tracks if necessary, and axles.
(f) Engine, including carburettor and magneto.
(g) Refill with engine oil.

2. Carefully inspect all the above named parts in the above mentioned order for loose nuts and bolts.
3. Examine tyres for cuts and pressure.
4. Park the vehicle in garage and allow the engine to run until the carburettor is empty, by turning off the petrol tap.
5. Drain the cooling system (between 1st October and 1st April).

The No. 1 of the driver's subsection, or the N.C.O. in charge of vehicles, should supervise these inspections, and see that they are conscientiously carried out. No self respecting unit would allow a horse, going out on to parade, to move off without such an inspection, nor would it neglect to examine the animal during a halt on a march for galls, etc., or yet again, who would thrust a horse into its stable unfed and uncared for, to catch a chill through lack of drying when sweating?

The motor vehicle involves no change in the principle, but only in the procedure, and so requires its parallel of inspection, examination, and feeding with lubricants, with the same regularity and care as the horse. The detection of troubles with a horse is usually much easier than with a machine. If the animal is illtreated, or neglected, or unwell, it soon proclaims the fact to anyone interested in it, by a falling off in condition, refusal of food, or one of the numerous well-known signs. A motor vehicle is, however, a deceptive beast, and will frequently run quite happily, apparently; yet all the while it is undergoing the grossest neglect. Sooner or later the inevitable will happen, and the machine will break down. It is then too late, and the damage is done. A very heavy repair is probably necessary, costly both in time and money. In most cases this can be avoided.

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Battery officer's inspection.

This brings us to (b), the battery officer's share in the inspection of vehicles. The necessity or otherwise for a specialist officer in each battery is a matter on which opinions are divided. Such a specialist is unnecessary in the horsed unit and in my opinion, the time must soon arrive when he will have to be unnecessary in a mechanised unit. Any R.A. section commander should be able to inspect his vehicles. The detail of his inspection would depend on the state of his training, but he could reasonably be expected to know the main defects of his machines, and to keep his battery commander informed as to their state in the same way as he would with his horses. When in doubt, he would consult firstly the brigade workshop officer, and failing him, in the event of serious trouble, an R.A.O.C. officer. To assist in these section commander's inspections, two excellent service handbooks exist, namely (a) "The M.T. Vehicle Maintenance Handbook," and (b), "The Maintenance Handbook for Armoured cars, Track and Half Track vehicles." These inspections should be carried out at least monthly.

For such a parade, the vehicle must be spotless in every part, and all bright metal work polished, whilst all lubricators should be full of oil. It must be borne in mind that this takes time, and the driver cannot be expected to achieve this result without a clear day's work before the inspection. On a dragon, or a vehicle of a similar type, at least two days are required. The time taken for an inspection by an officer varies with the state of his training, but normally would take at least two hours per vehicle if carried out thoroughly. In some units, such an amount of time cannot be spared, and I suggest that the inspection might be divided into four parts, one being taken each week, so that the whole vehicle can be inspected monthly in detail. It is, of course, better to inspect the whole vehicle on one occasion.

1st week.	Engine, including clutch and radiator.
2nd week.	Gear box, or boxes, and propeller shaft, back axle, not including wheels.
3rd week.	Chassis frame, bodywork or hull, tools and equipment, including lighting and starting set.
4th week.	Tyres or tracks, brakes, front axle, idler wheels, springs and steering.

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Furthermore a regular routine should be laid down for the following inspections and cleaning of parts mentioned underneath, under a No. 1's, or artificer's supervision, and a section commander might reasonably be expected to have such information in his notebook.

The dates or mileage of the cleaning out in :—

(a) Engine lubrication system and crankcase.
(b) Gear box, or boxes, and back axle.
(c) Cooling system and radiator.
(d) Petrol tank.
(e) Clutch.

Also the examination of,

(f) Wheels and tyres, or tracks.
(g) Brakes.
(h) Magneto and carburettor.
(i) Weekly inspection of accumulators.

and finally the date and the mileage of the last decarbonisation. This series of inspections is in use in a few units, and has greatly added to the efficiency of the vehicles.

Brigade technical officer.

Under heading (c), the term brigade technical officer requires some explanation. In my opinion, it is necessary to have with a unit, such as a brigade of artillery, some more expert adviser on transport matters, than the officer trained on an officers' short M.T. Course. Its need has been realised in horse drawn units, by the training of equitation instructors, and by veterinary courses, so it is necessary to have an officer with some advanced technical training to take charge of brigade M.T. workshops. His work should be in two portions, one the supervision and organisation of the brigade light repairs, and the other the keeping a check on the general state of efficiency of the brigade transport for the benefit of the brigade commander, by means of periodical mechanical inspections. We will deal with the first portion later. He should maintain a close touch with the local R.A.O.C. workshop, and, by his inspections, assist them in their inspections and general forecast of work.

War Office and other inspections.

There are various forms of inspection of transport arranged by

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the War Office, and in some cases the local O.M.E. is deputed to carry this out, by them. It has been proved repeatedly that his work can be considerably reduced and assisted by the careful maintenance of inspections by unit officers. I think that the brigade technical officer should be able to inspect the brigade transport, in detail, about three times annually, probably once at the end of the training season, once just before the commencement of unit training, and once during battery, or brigade training. His battery inspections might normally be arranged to coincide with one of the section commander's monthly parades, and in addition, he could see all battery officer's reports on vehicles as they are made. He should then be able to forecast, as a result of his inspections, and record of battery reports, within reasonable limits, the number of vehicles requiring light repairs or general overhauls, at least one month ahead; and so prepare either his own workshop, or the R.A.O.C. shop for the reception of the vehicles.

Administration and Organisation.

We now come to the last principle, that of administration and organisation. Dealing with the duties in connection with transport in a mechanised battery first, they are divided broadly amongst four people; (I) the driver I.C.; (II) the section commander and No. 1; (III) the battery captain and Q.M.S.; and (IV) the battery commander.

Driver I.C.

(I) His work consists in the care, maintenance, and cleaning of his vehicle, its driving, simple inspection, and the reporting of defects in the machine, and also of road accidents. The good driver I.C. will normally carry out his vehicle's maintenance and cleaning without much supervision, simply out of interest in his work, as would his predecessor, the horse driver, but he often receives too little consideration these days as regards hours of work. He is frequently required to drive a lorry for several hours daily, on various duties, without any time in barracks, for cleaning down and carrying out small items of repair work. He notes that his lorry is developing a small rattle here, and a dent in a wing there, all of which require a few minutes' attention, yet often the only time available is after a long day's work, when the rest of the battery is playing games, or off duty. Interest gradually disappears, and he

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begins to realise that no one appreciates his difficulties, or cares how the vehicle runs, so he neglects certain essentials, such as lubrication, and so on. A man must have at least one hour on his vehicle for inspection and lubrication every day on which he is running, and at least one whole day in every seven running days for a thorough clean down and lubrication. Also he should be ordered to report any defect, small or large, immediately after its detection, and it helps considerably if a pad of paper is kept in a convenient place for the man to put down his defect in writing, and hand it to his No. 1 on his return from duty. A.F. G.3518 is useful for this work.

Section Officer and No. 1.

(II) The section officer and No. 1 share would normally consist in the supervision of the driver and his vehicle, the carrying out of the various inspections mentioned previously, the checking and signing of demands on the Q.M.S. for expendable stores, such as petrol, oil, grease and cleaning material, besides arranging for the replacement of such parts as worn out outer covers, lamp bulbs, refills for fire extinguishers, etc. The investigation and preparation of reports on accidents for the battery commander would also come in the province of the subaltern officer, whilst he should also be responsible for the correct returns of mileage and journeys by drivers, besides ascertaining that they are supplied with routes, passes, etc., when proceeding on long journeys. Last but not least, it is of the greatest importance that the section commander should not allow his drivers to degenerate literally into "greasers." They should each have a suit of combination overalls, and these should be worn on all work involving anything other than actual driving. It is useless to expect a man to keep his vehicle in good condition, if he does not keep himself clean.

Battery captain and Q.M.S.

(III) The Q.M.S's lot is a difficult one in these days of mechanisation. It must be remembered that a vehicle is in the same position as a gun which is always in action. It must be kept well supplied with spare parts, otherwise it will not remain on the road. All this involves considerable work, and this is increased considerably by two factors, first, that there are no simple lists of spares, such as there are for guns, etc., but complicated "spare part lists," issued

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in most cases by the makers, one for each different type of vehicle, and they are being frequently revised. The second is, that unless a man has had M.T. training, he cannot identify parts required for replacement easily, besides which he has to maintain a loose leaf ledger to account for them, in the absence of suitable printed ones. Apart from these considerations, the quantities of stores to be handled have increased very greatly, and unless the most careful check is kept on demands, expense becomes considerable.

Until trained men become available, the best remedy I suggest would be the establishment of a brigade store which would obtain the necessary supplies of spares, and for the battery to demand them through the brigade workshop, thus centralising all issues of replacements under a semi-technical officer and staff. Expendable stores such as petrol, oil, lamp bulbs, grease, and so forth, would still be dealt with by batteries, and their Q.M.S. staff would be responsible for the upkeep of Army Books 5.

A part of the Q.M.S's duties should be the checking of vehicles' tool kits and equipment at the section commander's inspection. There is a great source of wastage in tool kits on lorries, etc., and it should be realised that the equipment of a service motor vehicle is generous, and the items are, in some cases, more numerous than a gun's lists of stores. Therefore, if no frequent tally is kept of tools, both at the handing over of the vehicle to a new driver, and when the vehicle is under inspection, losses will be considerable. When a vehicle is left for some period without a driver, the only safe way to leave the machine in garage, is with all the items on the "Vehicle Outfit list" withdrawn and locked up in the Q.M. store. Otherwise an irresistible temptation is placed in the way of other drivers and the machine is rapidly denuded of numerous small items.

Battery commander.

(IV) All the foregoing officers and N.C.O's naturally come under the battery commander's supervision. He can help very greatly by realising that adequate times for cleaning, inspection and lubrication must be allowed to drivers, and when a defect on a vehicle is reported to him, by ascertaining that some action is taken to remedy it according to its urgency. If this is carried out, he will

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be amply repaid, both by the length of time vehicles remain in action, and the number he will keep on the road. Another good rule to bear in mind, is to let the man who is in charge of the vehicle, drive it. Many officers and senior N.C.O's like to drive on parade instead of the driver I.C. It is exceedingly discouraging for a man who takes a pride in his vehicle, and treats it with a certain amount of sympathy, to have it taken away from him after he has carried out all the dirty work of lubrication and cleaning, and perhaps to have the engine badly raced and the gears damaged. Driving is distinctly the province of the driver I.C., and no one else:—although the officer or N.C.O. should be able to drive in an emergency, or for training purposes.

Brigade workshops.

To turn to the brigade, the formation of a brigade workshop to carry out light repairs, would, I think, be the most efficient way of dealing with units' vehicles. A proportion of each battery's artificers, would form the staff under the brigade technical officer, who would be, as already mentioned, an officer with a high standard of knowledge of M.T. repairs, and who would probably have, as his right-hand man, a senior R.A. or R.A.O.C., N.C.O. fitter. He would be responsible for small repairs, within the capacity of his shop—the extent of the overhauls are at present limited to £25—besides issuing spares to vehicles, and maintaining the necessary stocks of parts allowed to a brigade. He would require a Q.M.S. to assist him in this, who could be employed in addition to carrying out the necessary clerical work of the shop, such as dealing with vehicle inspection reports, and the work indents. The other part of this officers work would be the vehicle inspections mentioned previously, and it will be seen that this would be a whole time job in any brigade which is up to its full establishment of vehicles.

The advantages of such a system are in the main threefold, firstly the centralising of all repairs, under one officer's supervision, secondly, the pooling of repair experience in the whole brigade, thus improving the training of the battery fitters, who would as well, be working under a senior N.C.O's supervision, and thirdly, this specially trained officer would furnish the brigade commander with a technical adviser, who would be responsible for keeping him in touch with the state of the brigade vehicles.

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A DISCUSSION ON THE PRESENT ORGANISATION OF THE ARTILLERY BRIGADE.

BY MAJOR G. P. W. MEREDITH, *p.a.c.*, AUSTRALIAN STAFF CORPS (LATE ROYAL AUSTRALIAN ARTILLERY).

THIS paper is an attempt to attack that very debatable question—GUN v. HOWITZER—from all angles taking into consideration the information and experience gained in the Great War. The question can be viewed from three broad aspects:—

1. Materiel.
2. Personnel.
3. Tactical considerations.

1. *Materiel.*

(a) Initial cost is naturally the first thing to be considered as this consideration—other things being equal—would largely influence Government's final decision when re-arming in time of peace. An 18 pr. Mark V battery costs £15,100 and a 4.5″ howitzer battery £14,900, showing a balance of £200 per battery in favour of the 4·5″ how.

(b) Ease of manufacture and repair and rapidity of supply:—The 18 pr. Mark V carriage is much more complicated and difficult to manufacture than that of the 4·5″ howitzer. There are altogether 1,450 "stores," i.e. component parts, in the 18 pr. Mark V gun and carriage as against only 520 in the 4·5″ howitzer—a very important consideration affecting the number of spare parts to be carried in the field. Owing to the relative simplicity of the howitzer repairs in the field can be carried out with greater ease and rapidity than in the case of the 18 pr. The question of rapidity of supply and ease of manufacture is most important in time of war. In addition to having nearly three times as many parts the 18 pr. Q.F. gun and carriage is considerably more difficult to manufacture than is the 4·5″ howitzer: compare the recuperator system of the former with the buffer and spring recuperator of the latter. The long 18 pr. piece with its "ribs" and the short 4·5″ piece give another comparison. Apart also from mere replacements due to wear and

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enemy action, in a war of any magnitude the army must expand to many times its peace strength and that with great rapidity.

(c) Life of equipments: Average life.—In the Great War the average number of rounds fired per piece before reaching the condemning limit was:—

18 pr.	12,000 rounds.
4·5″ howitzer	10,400 rounds.

Damage from hostile fire: The percentage of 4·5″ hows. in the field knocked out by enemy fire averaged about 7% from 1915 to 1918, whereas the percentage of 18 prs. for the same period was about 3·5%, a point in favour of the 18 pr. gun. In this connection however, it must be remembered that in general the howitzer was much closer to the front line and was called on for the majority of counter-battery work and, as a consequence, attracted much enemy counter-battery shelling as well as coming in for a proportion of counter-infantry or "area strafing" shell fire through occupying these more forward positions. Furthermore it must be admitted that the flat plains of Northern France and Flanders are far from ideal howitzer country. In these circumstances therefore it says much for the ability of this weapon to adapt itself to unfavourable conditions and the percentage of losses must be considered small.

During the years 1915-1918, inclusive, 35·7% of the total howitzer casualties and 17·7% of the 18 pr. casualties were due to hostile fire. In other words the total casualties suffered by the howitzers consisted of the above and 64·3% of casualties due to mechanical and other defects whilst in the case of the 18 pr. the latter figure was 82·3%, thus showing that the 18 pr. guns suffered 18% more casualties due to mechanical and other defects than was the case with the howitzers.

(d) Ammunition. An 18 pr. round costs, in the United Kingdom, £3, against £4 18s. for the 4·5″ howitzer, with H.E. shell. The 18 pr. round being fixed ammunition it is necessary that all parts come together for assembly—in other words there is extra handling in the country of manufacture. The 18 pr. cartridge case is more difficult to make than the short 4·5″ case. On the other hand the 4·5″ charge is more difficult to make up and requires two sizes of cordite as against one for the 18 pr. An 18 pr. battery carries in limbers and wagons 688 rounds against 528 in the 4·5″ battery.

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(Note:—There are two wagons per 18 pr. gun against two and a half per 4·5″ how.)

(e) Effect: The average weight of metal, neglecting the fuze in each case, in an 18 pr. shell is $14\frac{3}{4}$ lb. compared with $28\frac{1}{2}$ lb. in the 4·5″ how., the metal per battery being therefore, in round numbers, gun 10,000 lb., how. 15,000 lb. The corresponding weights of H.E. are 1 lb. and $4\frac{1}{4}$ lb., the weights of H.E. per battery being:—gun 690 lb., how. 2250 lb. It is therefore clear that one 4·5″ H.E. shell is in effect at least equal to three 18 pr. shell and, further, the destructive power of a 4·5″ battery is, on that assumption, two and a third greater than that of an 18 pr. battery, while calculated from the relative weights of metal and H.E. the ratio becomes at least 6 to 1; as the costs of this ammunition are how. £2,500 and gun £2,060 respectively, this shows a tremendous margin in favour of the 4.5″ howitzer. It must also be remembered that the effect of 18 pr. H.E. against materiel is very slight; 4·5″ shell on the other hand can effect heavy damage against materiel and in addition has a greater moral effect.

Although the 18 pr. can fire up to 20 rounds per minute in bursts the average rates of fire are the same, viz., 4 rounds per minute each. Although the total energy developed by H.E. on detonation follows the linear law, i.e. four rounds of H.E. have four times the effect of one round, or in other words four rounds of H.E. develops four times the energy that one round does, it must be remembered that practically speaking it is an impossibility to get say four 18 pr. shell to hit the same spot at the same instant and to detonate together and it is in this way only that four 18 pr. shell can equal one 4·5″ H.E. against materiel. Troops could be quite safe from unlimited 18 pr. shelling in dug-outs that a few 4·5″ H.E. shell would penetrate and completely demolish. The relative values in the case of gas and smoke shell are $4\frac{1}{4}$ to 1 in favour of the 4·5″ howitzer.

18 pr. gas and smoke shell are notoriously inefficient owing to their small capacities, demanding almost ideal conditions for reasonable effect. Ideal conditions, however, are the exception and not the rule. The 4·5″ howitzer can, however, in normal circumstances put down a very efficient gas or smoke barrage. At present the 4·5″ howitzer is not equipped with shrapnel but the issue

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of this nature of shell is evidently a possibility as a fuze scale is provided on the latest Range Table, and the remaining velocity at maximum ranges is that demanded, viz. 450 f.s. Here again the increased capacity of the 4·5″ shell allows either more shot or larger shot as desired; probably a combination of both would increase the efficiency of the shrapnel shell. The point to be remembered is that owing to its steeper angle of descent howitzer shrapnel must be "opened" much sooner than gun shrapnel. Bursts about 30′ above the line of sight are required.

2. *Personnel: Rapidity of training.*

Owing to the rapid expansion of the Army demanded by a war of any magnitude this consideration is a very important one and there seems to be no doubt that the average gunner will master the simpler howitzer equipment more quickly than he will that of the 18 pr. with its greater complement of "stores." The personnel of an 18 pr. battery number 165 against 175 for the 4·5″ howitzer, a slight advantage for the gun, but the 4·5″ howitzer battery has two wagons more which accounts for the extra personnel. As the howitzer is able to and normally will fire from well concealed and covered positions compared with the more open positions demanded by the 18 pr., the personnel of howitzer batteries have a greater feeling of security and moreover are less open to the counter-battery fire of opposing field guns, i.e. in good (normal) positions they can only be attacked by howitzers, whereas the gun which requires a more open position can be attacked by both guns and howitzers. It must be admitted that this argument is not borne out by our experience in France and Flanders but there the need for artillery required the utilisation of howitzers in positions that were more often than not far from the ideal.

3. *Tactical considerations.*

F.S.R. tells us that the Imperial Army is designed, organised and armed, to fight in all countries and climes. We in Australia have adopted as a basis, and rightly so, the organisation, etc., as laid down by the War Office. Our army is, however, primarily designed for home defence and in discussing the question of artillery one must take that factor into account. Those parts of Australia where it is reasonable to presume we would have to fight in case

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of invasion lend themselves to the employment of howitzers, i.e. the country is very undulating with steep gullies and frequent belts of timber, flat open plains being the exception. Generally speaking Australian terrain is probably little different from that (excepting northern France and Flanders) over which the Imperial Army may have to fight. Whilst doing tactical schemes in broken country such as described, this fact is forced home—for every one suitable gun position there are literally a dozen or more typical howitzer positions and in certain districts near our vulnerable points the trouble is to find any suitable field gun positions at all. In this country at short and medium ranges the howitzer stands alone being able, owing to its curved trajectory and greater shell power, effectively to shell places inaccessible to the 18 pr. gun. Were conditions of terrain the only factors to be considered the answer would be markedly in favour of the howitzer.

Counter-battery work is an important task and, well done, makes the way much easier for the infantry. During the late war the 4·5″ how. came in for a great deal of this work as the shell fire of the 18 pr. is not effective against artillery unless a direct hit is obtained. The 4·5″ howitzer, however, being more powerful, does not need to make a direct hit in order to disable a piece. Owing to its ability to tuck into almost any fold in the ground the 4·5″ howitzer can give much support to the infantry and fire at much shorter ranges than can the 18 pr. and, in addition, at these short ranges is practically immune from hostile field gun fire while it can attack both guns and howitzers. Against enemy in trenches, pill-boxes and strong points generally, the howitzer is more efficient owing to its steeper angle of descent and its greater power. In normal warfare i.e. "open" as opposed to "trench" warfare, the howitzer will be more difficult for hostile air observers to pick up as it can make use of small belts of timber, deep folds and depressions, whereas the 18 pr. must have an open or semi-open position to enable its shell to clear the crest or obstacle in front. The gun of course has the advantage of range, but up to its extreme range there is no possible doubt of the supremacy of the 4·5″ howitzer both against troops and materiel under all conditions, with one notable exception which we will now consider.

"The old order changeth" and nations have to-day as their

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most formidable weapon the "tank," and the extra and onerous duties of anti-tank defence have been thrown on to the divisional field artillery. True, the infantry now have the 3·7″ howitzer for the "canon d'accompagnement" and against machine guns and centres of resistance it is a splendid weapon but against tanks it is not a success.

Although this paper is intended solely as a consideration of the merits and demerits of gun v. howitzer, it is impossible to conclude without reference to that very controversial subject—anti-tank defence. This is necessary for the especial reason that the Mark V 18 pr., with its split trail and wide arc of fire was designed primarily with a view of defence against tanks, and F.S.R. II (1924), Section 94-8, provides for a proportion of the defending artillery being specially detailed for anti-tank defence. Apparently the role of the artillery against tanks in the encounter battle and in attack against counter attacks (by tanks) is not yet stabilised as no mention is made of it in this publication. The latest available information on the subject appears to point definitely that the 18 pr. gun is not an efficient weapon against "jinking" tanks whether it be the Mark V or the Mark IV on the new platform, or the new "Birch" gun on S.P. mounting; the rate of fire and traverse being too slow and the trajectory not flat enough. The 18 pr. would also appear to be unnecessarily heavy for anti-tank defence. As before mentioned the 3·7″ howitzer is certainly not a satisfactory anti-tank weapon. In what direction, therefore, can we look for a satisfactory solution of this problem—i.e., to give the infantry reasonable security against tanks, and largely to relieve the divisional artillery of this extra duty and free them for their main role of assisting the infantry by attacking guns, machine guns and infantry? So far, our (i.e. British) war experience has largely been with tanks and not against them consequently our anti-tank measures are based principally on the result of peace manœuvres. We can, however, consider a parallel case wherein we have practical experience.

Tanks have been aptly called "land-ships," let us go a little further and liken the "large" and "medium" tanks to a T.B.D. and a "whippet" tank to a C.M.B., and then consider the weapons the coast artillery have found necessary to adopt as an antidote to these ships. To defeat the T.B.D. it was found necessary to adopt a gun having a rapid rate of fire but capable of being elevated,

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traversed and fired by one man—the elevating and traversing to be as fast as possible. The only way of achieving this aim was to have a nicely balanced gun fitted with a shoulder piece. To meet these conditions the Hotchkiss 6 pr. Q.F. gun was evolved. Similar but more arduous tasks exist for the anti-tank gun. The tank is roughly only one tenth the length of a destroyer though its speed is approximately one third (15 m.p.h.), but it moves in three dimensions as the lay of the ground changes. The arc of probable fire would normally be greater for the anti-tank gun as hostile tanks may be expected anywhere along the front covered making rapidity of traverse, elevation, rate and opening of fire essential.

The whippet tank is roughly a third to a quarter the size of a C.M.B. and the speed is about one half (25 m.p.h.). Against the C.M.B. a species of pom-pom has been adopted, its characteristics being great rapidity of fire and facility of traverse and elevation, i.e. by shoulder piece. The idea being to open fire just ahead of the attacking C.M.B. and lay a beaten zone into which it runs and is promptly sunk. A similar weapon and the same tactics could be successfully employed against whippets and larger tanks. These weapons could be provided with mountings allowing of high angles of elevation to permit of them being used against hostile aircraft flying in the safe zone, i.e., outside the limits of Lewis gun and rifle fire but too low for effective fire by A.A. batteries. Summing up it would appear that the 6 pr. Hotchkiss on a low S.P. mounting should be able to defeat "jinking" tanks and should form the main anti-tank weapon and that two $1\frac{1}{2}$ pr. or 2 pr. machine guns of the pom-pom type should be included in the equipment of the battalion, replacing two of the extra machine guns recently allotted.

Let us now summarise the conclusions arrived at. They are :—

(a) The 4·5″ howitzer is slightly cheaper and much easier to manufacture than is the 18 pr. Mark V. or IV.

(b) 4·5″ ammunition is relatively cheaper and more powerful.

(c) Two wagons and limbers more per battery are required than with the 18 pr.

(d) Personnel can be more easily trained.

(e) Damage to enemy materiel and personnel is greater with the 4·5″ howitzer than with the 18 pr.

(f) The average terrain on which we would have to fight is more favourable to the employment of howitzers.

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(g) The 4·5″ howitzer is practically useless against tanks whereas the 18 pr., though not satisfactory, is the most effective anti-tank piece we have.

(h) History proves clearly that each new weapon of offence has necessitated the creation of its own particular antidote, therefore, to defeat the tank a new weapon capable of meeting and overcoming the peculiar tactics of the tank must be evolved. The attempts to adapt existing weapons to meet conditions for which they were not designed can never be satisfactory.

Assuming the provision of effective anti-tank weapons and considering the nature of the country i.e., timbered and undulating, over which it seems reasonable to assume we, in Australia, would have to operate in case of invasion and bearing in mind the advantages which it undoubtedly does possess, it would be an improvement to increase in the brigades of the divisional artillery the number of howitzer batteries to two or even three displacing a similar number of gun batteries.

Further the artillery of the cavalry division consists of one brigade of three 18 pr. batteries and no howitzers, and it would find the greatest difficulty in giving effective support to the cavalry in our normal, i.e., timbered and undulating country. The reason for the absence seems hard to find unless it be from a mistaken idea that the 4·5″ howitzer is not a mobile weapon. Actually it has 28 lbs. less, in the case of the 18 pr. IV and 112 lbs. less in the case of the 18 pr. V weight behind the team and can turn in as small a circle. On the basis of a three battery brigade it is for consideration whether one or two batteries be replaced by howitzers or whether each battery consist of one section of guns and one of howitzers, the latter would probably complicate ammunition supply. Undoubtedly the substitution of howitzers for guns in the artillery of the cavalry division and the division would materially increase their usefulness and allow them to function in their legitimate role of helping forward their troops in attack and supporting them in defence, a task which as at present organised they cannot carry out effectively in Australia.

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ECONOMICS AND MODERN WARFARE.

By Colonel J. F. C. Fuller.

IT may be taken as an axiom that, when any problem other than one of a purely sentimental, or emotional, nature is under consideration, popular opinion is always wrong. The reason for this is not far to seek. The masses of the people intellectually live in the past, and gaze upon present-day problems through the mists of yesterday, just as they invest past problems with the atmosphere of the time and locality in which they live. Intellectually, it may be said, with little fear of contradiction, that any problem of a novel nature is incomprehensible to the crowd, and by crowd I mean not only the proletariat but all people who are unable to connect effect with cause and harmonise cause and effect with the ever changing conditions which surround world events.

A little less than fourteen years ago, Europe was plunged into a world war in which every adult European was directly affected. Fourteen years ago, at least nine hundred and ninety-nine out of every thousand of these human beings looked upon war in the abstract, that is: All wars were to them but one war, just as all storms can be concentrated in the word "storm," irrespective as to whether they are snow-storms, hail-storms or thunder-storms. So also with war, it was simply an abstract idea to the majority, symbolised by a word denoting soldiers and sailors fighting each other without reference to date, locality or cause. Even to those who passed as educated, outside armament, there was little difference between the Crusades, the Thirty Years War, the Napoleonic Wars, and the Russo-Japanese War. All were wars, cataclysms which from time to time engulf nations, periods of infamy, or of glory, according to the personal sentiments of each individual.

Sentimentally public opinion was right, although it rested on no rational foundation. War is both infamous and glorious. Evil it is, because in a perfect society war is an impossibility, just as in a state of physical perfection indigestion is an impossibility. War is not, as public opinion supposes, a thing in itself which flashes out of the night light a falling star, for war is the outward and

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visible sign of inward and social disease. Were it not for the imperfections of peace there would be no war. If war is an infamous conflict then in proportion to its infamy it is a glorious conflict, for unless, like a fever, the poisons of peace are thrown out through war, civilisation must cease to be. It must perish, as a man perishes if he cannot rid himself of a poison tormenting his system. War is glorious and infamous, but only in so far as it is related to the state of peacefulness which preceded its outbreak; for in itself it is inane. Of the last war, Robert Briffault says in his book *The Making of Humanity*: "The war was but the visible avatar, the materialised out-throw of the multitudinous abominations amid which we lived." My argument could not be put clearer, since had not the war taken place these multitudinous abominations would still be rotting the bowels of the civilised world. Consequently, the infamy, or glory, of the war can be assessed only when it is decided how far it succeeded in ridding the world of the poisons which begat it. Did it effect a permanent cure, or a passing remedy? If the former, then it was the most glorious war ever fought, since no preceding war has succeeded in doing so. If not, and obviously it was not so successful, then surely should not its infamous effects persuade us to probe deeper and so discover their infamous causes? Then, like a surgeon, we may learn how to cut these tumours out.

The answer is: Yes! Without question it is the rational thing to do. But public opinion is irrational, or rather non-rational, and the people having suffered much during the last war, and much on account of it since, draw circles and triangles and recite magical incantations to drive the idea of it away. Did Jenner treat small-pox by anathema? No, for his process was rational. To-day, the masses seeing the world still in a turmoil, largely due to the poisons injected under European skin by the quack doctors at Versailles, are terrified at the idea of another war which, as they, mentally, live in yesterday, appears a monstrous repetition of the last war, for it is magnified by the present atmosphere of fear.

Almost daily is the idea of war laid under the interdict of public opinion and anathematised, but no words will lay it. "War," says one recent writer, and I quote almost at random for so many are these effusions, "is a vile futile Satanic thing which those of us who

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knew it at first hand saw it to be—a filth-bespattered transaction in which we received four-pennyworth of glory in exchange for our pound note of sacrifice." All this may be most true, but what is the use of it? It is true that words may change public opinion, but if I am right in supposing that war is caused by social desease, public opinion cannot cure this disease unless it understands its nature. To those who do not like vituperation, the alternative is to fall back on the League of Nations.

Since its inauguration in 1919, the League of Nations has maintained an unbroken silence on the true causes of war. This is shown clearly by the time devoted to Disarmament. It is true that soldiers fight with weapons, but surely it is putting the cart before the horse to suppose that weapons make soldiers fight. If one nation alone were armed, there might be some truth in this conception, but there is no truth in it if all nations are equally well or badly equipped. Though the results of wars may depend upon weapons, their causes can no more do so than the causes of carpentry can depend upon hammers and pliers. It may be said: But if the carpenter is deprived of his tools carpentry will come to an end. The answer is "no," for all the carpenter will do is to return to the stone age. It was not swords and lances which made the Crusades, or arquebuses and pikes the Thirty Years War, or rifles and machine guns the last World War, the causes were vastly deeper, so deep that I am of opinion that, if in 1914 all European nations had been armed with broom sticks the war would as inevitably have been fought. As regards the problem of the maintenance of peace, for seven years the League of Nations has been travelling along the disarmament tangent towards infinity. That is to say, if conditions remain as they are, the world will long have to come to an end before a solution by this road is discovered.

But will conditions remain the same? We know, from inference, that they will not. Therefore, if public opinion can be brought to realise what changing conditions will mean in the future from what they have meant in the past, humanity may be spared another war, for war is only possible if peace remains imperfect. The solution of the war problem has therefore nothing whatever to do with armies, or navies, or air forces, but everything to do with society and its vices.

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The condition of civilisation to-day bears only the remotest resemblance to the civilisation of the middle of the eighteenth century, that is before the advent of the industrial revolution. In 1756, at the opening of the Seven Years War, every Kingdom in Europe was self-contained and socially little affected by war as long as its frontiers were defended. War was not a national concern, but a royal concern, for public opinion, in its modern sense, was scarcely born. Twenty years later, public opinion became manifest in America, and, thirteen years after the Declaration of Independence was signed, it became manifest in France. The people had largely come into their own, and the result was that kingdoms shrivelled up and nations were born. To-day, public opinion, and its ultimate expression, political action, are about a hundred years out of date, that is to say: The people and their political representatives are to-day living in a mythological world, a world which did exist three or four generations ago, but which no longer exists. To the intricate international problems of the twentieth century, they are applying the crude political machinery of the early nineteenth century. As well attempt to move the Mauretania by the engines of the 1819 Savanah; but public opinion understands nothing of this, and when its feeble engines fail, all it can do is solemnly to convoke a committee of high-soulled people to anathematise the problem, which nevertheless refuses to be charmed away. To discover where public opinion errs, or rather to banish its obsessions, demands a little history.

In 1757 Clive won the battle of Plassy, militarily a small affair, since Clive's army numbered but 3200 English and Native soldiers and his losses were 22 men killed! Yet Plassy was the most epoch-making battle in English history, for Bengal was handed over to wholesale robbery and spoliation. Millions in gold and silver, including much of the wealth of the Incas of Peru, which from Europe had for generations filtered eastwards, and had been hoarded by Indian potentates, flowed into England. Then came Warren Hastings, and as Macauley tells us: "The object of his diplomacy was at this time simply to get money." The effect of this wealth was instantaneous—in 1760 the industrial revolution was born. This year the flying-shuttle appeared and coal began to replace wood in smelting. In 1764, Hargreaves invented the spinning-jenny; in

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1768, Watt perfected the steam-engine; in 1779, Crompton contrived the mule, and in 1785 Cartwright patented the power-loom. "In themselves," as Brooks Adams points out in his *The Law of Civilisation and Decay*, "though these machines served as outlets for the accelerating movement of the time, they did not cause that acceleration. In themselves inventions are passive, many of the most important having lain dormant for centuries, waiting for a sufficient store of force to have accumulated to set them working. That store must always take the shape of money, and money not hoarded, but in motion . . . . To the capitalist, then, rather than to the inventor, civilisation owes the steam engine as a part of daily life."

From the narrower point of view of social morality, the spoliation of Bengal was a crime unrivalled since Alexander laid hands on the treasures of Persepolis and Ecbatana. From the broader world point of view it was one of the most beneficial acts ever accomplished, for, from this point of view, hoarding of wealth is a crime against progress. The hoarders were the criminals and not Clive and Hastings, from whose spoliation the modern world arose, for the gold of Bengal was the blood of the industrial revolution, which has paid back to India a thousand-fold the price of its capitalisation. Yet in spite of this gold, and in spite of inventive genius, the spread of the New World Order would have been sadly delayed but for one man—Napoleon, the child of the Revolution and its victim.

Except for England, the French Revolution found Europe governed by a decayed feudalism totally adverse to the idea of trade, which to the aristocracy of the period was the stigma of all things ungallant. By the date of the battle of Jena, 1806, Napoleon had uprooted every kingdom of importance in Western Europe. Politically he set peoples free, and from the *débris* of his battlefields they arose as modern nations, whose very soil was rendered sacred by their blood. From 1796 to 1806, Napoleon pulverised Europe, from 1806 to 1815 Europe pulverised Napoleon. The new born nations destroyed him, he who more than any other man had created them was stricken down by them, because from 1806 to 1815 he aimed at establishing a universal monarchy, that is a despotism compared to which their decayed feudalism was freedom itself.

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In 1756, when Clive went to India, the British National debt stood at £74,575,000; in 1815 this sum had been increased to £861,000,000, and the difference is a fair measurement of the economic progress of the intervening sixty years. Europe, nationalised, became the market of Great Britain, and fifteen years after Waterloo England ceased to be an agricultural country, for her key industry had become manufacture.

Broadly speaking, in 1760, international trade was accidental, or rather was a factor of such small importance that, during war time, no kingdom was seriously affected by its loss. In 1830 international trade was almost entirely British. If all the nations of the world had gone into alliance against Great Britain, as Napoleon attempted to force Europe to do when he introduced the Continental System, Great Britain would have been ruined, for she was literally a nation of shopkeepers. As the bulk of the world's trade was British, by economic pressure and resistance Great Britain could make the life of any one of her larger buyers, who daily were becoming more and more dependent on her goods, so uncomfortable, that this pressure and resistance became the guarantor of European peace. Opposed by no competitors, there was no necessity for her to protect herself against competition, consequently her economic policy was soon based on free trade, and her foreign policy on the maintenance of peace, since war is antipathetic to trade.

When other nations began to become industrialised, as they did between 1830 and 1870, in spite of foreign competition Great Britain had gained so great a start in manufacture and commerce, that not only could she maintain her free trade policy, but turn it to advantage by making London the world's clearing house—the heart of international trade.

In 1870, a sudden change took place in economic Europe, on 1st September the battle of Sedan was won by Prussia, and in the history of modern economics it ranks in effect only second to that of Plassy, for the outcome of Sedan was not only the consolidation of the Germanic States into an Empire, but the sudden influx into Germany of £200,000,000 of French gold. In a few years, Germany, following the course trodden by England, passed from an agricultural to an industrial footing, and soon became a competitor of Great Britain. In this competition is to be sought the true causes of the World War of 1914-1918.

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Before the advent of the industrial revolution nations were self-contained and self-supporting, the key industry of every country being agriculture, consequently the object of war was to increase the size of the realm. From the close of the seventeenth century, wars of conquest were persistently fought with this object in view, and the political weapon used was armed force. After its advent, for over two generations trade was British, and in the Napoleonic Wars it was soon realised that economic pressure could be turned into a weapon, consequently Great Britain adopted the blockade and Napoleon the Continental System. When, however, trade became completely internationalised, as it did before the close of the nineteenth century, commodities ceased to belong to any one nation, they were in fact common property. So much so was this the case, that the prosperity of each industralised country was relative to the prosperity of all combined. Power to sell depends on power to buy; far more complex still, to buy and to sell demand the establishment of credit, consequently the national wealth of each industrial power was invested not only in its own industries, but in those of other nations with which it traded. Commercially, the civilised world had become a single complex industrial machine, the health of which depended on the observance of the law of economic interdependence, which demanded the finest adjustment in the balancing of trade. If this balance were not maintained, exchanges at once began to fluctuate, and the result was political strain; for in a commercial age nothing affects a citizen more than to go to bed a prosperous man, and wake up in the morning to find, through no fault of his own, that he is a pauper. If his own government is to blame he can turn it out of office, if the culprit is a foreign government, outside diplomatic pressure, he has no alternative to war.

Once Germany became industrialised the result was a dislocation of world markets. Not only did competition take place between her and Great Britain but between all manufacturing countries. These, to protect themselves against what was called "peaceful penetration," resorted to protective tariffs and customs. Thus did protection, that is economic pressure and resistance, become a diplomatic weapon. Strictly speaking it is no weapon at all, since trade is not national but international, and for its

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health depends upon interdependence and not independence. When in the pre-industrial period a nation decided to go to war with another, the war was a duel between the two nations, and all other nations were onlookers. But when a diplomatist exerts economic pressure, by raising or imposing a tariff, he influences all countries, some more and some less, and not merely the country he intends to coerce. The result is immediate—it is a hostile international feeling.

If the industrial revolution had taken place simultaneously throughout the world, the probabilities are that industries would have become specialised according to local conditions, and universal free trade would have resulted, in which case economic pressure could not have been used as a weapon. This, however, did not take place, and consequently each country as it became industrialised protected its infant industries until home consumption was satisfied. For example: To-day the U.S.A. is surrounded by a tariff wall because her home markets are still sufficient to absorb the products of her industries.

The result of this was that, shortly after the Franco-Prussian War down to the outbreak of the World War, the law of economic interdependence was constantly infringed. Trade, which for the prosperity of all nations should be freely exchanged, was dammed and restricted by political action. To circumvent protection the eighties witnessed a frenzied search after new markets and new sources of supply. The uncivilised world was rapidly divided up among the competing powers. Germany, then controlled by the nationally minded Bismarck, was a bad last in this land grabbing race, and by the time her growing industries had satisfied her home needs, there was little left for her to grab.

Governments acted as they did, since they were the representatives of public opinion—the political part attempting to swallow the international whole. By which I mean: When each country was self-supporting, each politically and economically was autonomous, but now that every industrial country depended on the economic world as a whole, each was so intricately interwoven economically with the other that all save political autonomy was shared in common. This not being realised, a solution to all economic difficulties was sought through political power, just as

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in years gone by the Papacy, a religious organisation, attempted to solve temporal problems by spiritual power. The result of this earlier intermixture of two incompatibles was a series of devastating religious wars, and so also, from about 1890, the attempt to solve an international problem by political means resulted in a series of economic wars which eventually embroiled the entire civilised world in the War of 1914-1918.

No sooner had the uncivilised world been partitioned between the greater industrial powers, than a scramble took place in China. In 1894, Japan burst through China's front door, and showed how feeble the Celestial Empire was. The U.S.A. then went to war with Spain in order to seize the Philippine Islands, and so gain a naval base in the China Seas. In 1897, Russia occupied Port Arthur, Great Britain Wei-Hai-Wei, Germany Kiao-Chau, and France Kwang-Ghow, and China was compelled to open her main ports to European trade. The results of these high-handed acts were, the Boxer Rising of 1900, which attempted to put an end to this "peaceful" penetration, and four years later the outbreak of the Russo-Japanese War, in which Japan regained the position she had lost through European pressure in 1894.

Meanwhile France and Great Britain quarrelled over Fashoda, and the latter country went to war with the Boers in South Africa, the cause of this war being an economic one. Germany, finding all possible markets and areas of supply occupied, set out searching for pretexts which would enable her to seize ready made ones. The result was not only the building of a vast navy, which threatened British frontiers, but the explosion of one crisis after another, each one more warlike than the last. An extension of economic control in Asia Minor was aimed at, and the complications arising out of this stimulated the two Balkan Wars of 1912-1913. Meanwhile the Agadir incident took place, which led to Italy seizing Tripoli before Germany could do so. Thus it happened that the World War of 1914-1918 was the culminating act of a war period which in itself was symptomatic of the economic friction and chaos produced throughout the world during the preceding generation by statesmen attempting to solve international problems by national means. Even so astute a politician as Joseph Chamberlain did not understand the folly of all this. For half a

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century British free trade policy had by minimising economic friction protected the frontiers of the Empire far more effectively than a doubling of the navy and quadrupling of the army could possibly have done. Yet, in 1902, this noted statesman, in order to stimulate home industries, sought to introduce a system of preference which not only would have abolished this security but simultaneously have irritated every foreign nation trading with us. It was not the growth of armies and fleets which caused the World War, but the insistence of politicians of the Chamberlain type in attempting to solve economic world problems by national and political means. Since 1870, economic pressure in one form or another, had been used as a weapon, or tool, to accumulate wealth. The same spirit was manifest as possessed the Vikings of the early Middle Ages. The wisdom of Adam Smith was forgotten: At the end of the eighteenth century he had pointed out, that if commerce is allowed to be free the profits will be shared by every country engaged in it, and that consequently the benefits of trade are reciprocal. In place, these politicians fell back on the worn-out doctrine that the wealth of a country consists of its gold, and that consequently the object of trade is to drain other countries of the precious metal. From about 1870 an economic war was declared throughout the industrial world, the sole object of which was individual, or national, profit at any price. Wages were kept low, and the result was social unrest; protective tariffs were imposed, and the result was international irritation. As things were, the civilised world was riding for a fall—a World Revolution or a World War. As politicians and statesmen naturally dread the former most, since it means their overthrow, when economic pressure could be carried no further they appealed to the guns, and from 1894 to 1918 artillery seldom ceased its thunder.

When war was declared in 1914, each nation blamed the other for its outbreak. This was natural enough, but what none could see was that a war between any two great industrial nations must rapidly evolve into a world war, and directly influence every civilised man and woman. For years past the citizens of each separate country had been proud to consider themselves as nationals, the war very soon produced conditions which showed them that in spite of their patriotism, the world was an economic whole,

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and that economically they were even more international than national. Stocks fell, and people became bankrupt; food grew scarce and rationing had to be resorted to. The Englishman, glorying in the fact that he was English to the backbone, for year after year had sat down at his dinner table entirely oblivious that on it was daily placed before him the spoil of five continents, and that nearly everything he ate and drank came from any other land save his own. The very foundations of his life were international, yet he was delighted when he heard that Germany was nearing industrial ruin.

From the military point of view it was the same. In August 1914, the war was proclaimed in the name of nationality, each nation controlling its own army as if each were a self-contained and autonomous unit. The British Army when it landed in France was actually ordered not to involve itself with the French, it was British and had nothing whatever to do with France. So the war dragged on until the law of economic interdependence could no longer be resisted. Then everything was pooled, raw material, foodstuffs, ammunition, and even the higher command. The Allied Powers who had entered the war in the name of nationality, ended it by becoming completely internationalised.

From start to finish the war was an economic struggle, for military action was entirely subordinated to economic pressure. The main battlefields were in the industrial areas, and the main weapon was blockade, in one form or the other, which prevented these areas being supplied. The war opened as a contest of armies and ended with the destruction of factories, victor and vanquished being equally impoverished by their loss. It was not a glorious war, but an infamous war, since no sooner did it conclude, than all nations, having learnt nothing from its ruin, returned to their political conceptions of 1914, and attempted to solve the intricate international problems of peace by national politics, in fact to reconstruct a shattered world on the old agricultural idea of autonomy. Worse than this, a host of new nations was created, and allotted ethnographical frontiers without the remotest idea of what their influence would be on international trade. If the Europe of 1914 was diseased, the Europe of 1919 was no less so. To-day every old complaint has assumed an accentuated form, and the only reason why peace

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is maintained is the physical, moral and economic exhaustion caused by the war.

For Europe, as she is constituted to-day, there would appear to be three possibilities: The first is, that when nations have recovered their strength the World War will be continued, and quite possibly European civilisation will founder. The second is, that the League of Nations will evolve into a European, perhaps even a World, Economic Council, and create, if not a sanction, at least a sentiment, which by degrees will bring popular opinion to realise that problems of international trade cannot be solved by politicians whose very status depends on national electorates. The third is, that America will at first modify her tariffs, and perhaps ultimately adopt a free trade policy. Should she do so, whilst protection still reigns in Europe, then seeing that she possesses the bulk of the world's gold, and is the main representative of the second industrial revolution—oil-power—Europe is likely to become the satrapy of America.

Of these three possibilities the first spells ruin, and there are certain signs that public opinion is beginning to realise this. Not only is the establishment of the League of Nations a symbol, if no more, of Europe's discontent with the pre-war political conditions, but the insistent harping on the horrors of the next war, and the demand for disarmament show that public opinion is deeply concerned. Though, I feel, that to attempt to eliminate foreign wars through disarmament, which is purely a national restriction, is to delude ourselves that the maintenance of peace can be based on other than international foundations, its discussion may at length lead to the discovery of the true foundations of war—economics and finance. There are already signs that this is realised, for, since the Locarno Conference of 1925, an International Economic Council has been established, the object of which is to collaborate with the International Chamber of Commerce, and the International Labour Office.

This is a welcome sign, for it shows that the breakers ahead have been seen, so that if those who are in command of the mixed fleet of European States are able to change their course before the political wind drives western civilisation on to the rocks, Europe may be saved. If they swing their helms, or even if by discussions

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on disarmament the next storm can be averted for a generation, then I see no reason why the second or the third possibility should not become a probability. These two may be considered together, since the end of each is the same though the means of attaining this end differ.

The goal of European peace is internal national tranquillity and absence of foreign wars. The first is a political question, and the second an economic one. The confederalisation of European states can solve neither of these problems, and must end as all confederations have ended, namely, in war, e.g.: Ancient Greece and Modern America. Federalisation, which may be the alternative end, can only be of slow growth. When nations as firmly believe in the economic unity of Europe as they now believe in their individual autonomy, federation may be possible, but not before. Nations must therefore be considered as remaining politically independent, which means that they must continue to control their own armed forces without which law and order cannot be maintained, and without law and order there can be no autonomy. Recently, at the Preparatory Commission for the Disarmament Conference at Geneva, the Russian delegate, Litvinoff, like all Russians, possessed of a childlike naivety, proposed the total abolition of armies and fleets. Obviously, could this proposal be carried out the result would be revolution and mob rule throughout Europe, i.e. the present aim of Russian foreign policy.

As I have already pointed out, the establishment of peace is to be sought in quite another direction, namely, through the application of the law of economic interdependence. The question is, consequently, how can this law be brought into general operation? The answer is a two-fold one: Either by the will of Europe, or by outside pressure—the will of America.

There are many signs that the age of the great industrial magnates, such men as Henry Ford, is coming to an end. This may at first thought seem to be an unqualified assertion, seeing that to-day international trade largely depends on their work. Passing events however show that the power of individuals is rapidly being swallowed up by immense business syndicates and co-operative companies. During the last five hundred years changes in power have been definite. The Barons of the Middle Ages were replaced

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by the economically minded landed aristocracy of the sixteenth century; in the nineteenth century these men were ousted by the industrial magnates; who in their turn, so I infer from present-day world conditions, will be replaced by financial despots who will control the great business syndicates which are now rapidly arising.

If this deduction is correct, then Europe and America are to-day on the threshold of a period of financial centralisation, a period which may be compared to the rise of the Roman financiers during the first century B.C. In 90 B.C. Lucius Marcius Philippus estimated that there were only 2000 wealthy families in Italy. This was before the First Civil War, after it and the second financial centralisation became far more pronounced. Macaulay, in his preface to *Virginia* says: "The ruling class in Rome was a monied class, and it made and administered the laws with a view solely to its own interest. Thus the relation between lender and borrower was mixed up with the relation between sovereign and subject." From many hands wealth passed into a few hands, and then, ultimately, financial control of the Empire passed into the hands of one man, and what Cæsar with all his wealth had schemed Augustus carried out, and by dissembling his autocracy under republican forms he imposed an absolute despotism on 120 millions of people.

Once financial control of the Empire had been established, Augustus reorganised the army, replacing the mercenaries of the Civil Wars by a permanent police force. The Prætorians, hitherto mainly recruited from Italy, Spain and Macedonia, were replaced by barbarians who Dio Cassius informs us were repulsive to the Romans and terrible to look upon. For four hundred years this corps of hirelings crushed revolt within the Empire. The Roman fiscal system was, however, based on usury, it was an "engine for working bankruptcy" and ultimately when bankruptcy took place this all powerful police force could no longer be paid, and the result was the destruction of the Empire and the eclipse of European civilisation. Then for a thousand years warfare was the staple industry of Christendom.

I do not suggest that these events are going to repeat themselves in detail; but looking at the world as it is to-day, it is possible, even probable, that their tendency will once again manifest. In the past financiers have made great fortunes out of fluctuations in

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trade—through gambling and rigging markets. But once they fully realise (many so I think do) that far greater fortunes can be made through enslaving industry—by turning the entire industrial world into one vast smooth-running machine, the interest they will draw on their loans will be enormous. To such men war will be anathema, and being from necessity divorced from the ideas of nationalism, they will through financial power establish a period of peace. To do so they must be able to convert this power into physical force, as Augustus transformed the power of gold into the force of his Prætorians. The question now arises, how is this to be accomplished without centralisation of political power, as it was centralised under the Cæsars?

To-day each government maintains internal stability by a national army: A conscript force, such as in France: a militia, such as in Switzerland; or a regular and professional army, such as in Great Britain and Germany. In war all these military organisations can be expanded to include every adult man of fighting age, as happened in 1914-1918, and all are based on infantry, which is *par excellence* the arm of democracy. Nevertheless, since the last war, a tendency towards the replacement of infantry by mechanised troops, such as tanks, armoured cars and aircraft has taken form—the logical outcome of the influence of the second industrial revolution—oil-power—on military organisation. At present this transformation is in its infancy, and it may take fifty and more years to attain manhood. That it will fail to do so is unlikely, seeing that military force has always been based on the main industry of its day. In the feudal age it was robbery, or its first cousin, and as roads were few and bad, cavalry was the ideal arm for the foraying baron. In the agricultural period the yeomanry and farmers were the main source of military recruitment, so we may infer that in an industrial age it will be the engineer and the mechanic, consequently the mechanisation of military power is fore-ordained.

When this transformation takes place, the result will be that agricultural nations, and industrial ones deficient of coal and oil, will be unable to engage in foreign wars, consequently the power to wage such wars will become centralised. Wars will, therefore, become less frequent, and as financial centralisation increases,

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economic frontiers will vanish, and trade becoming freely internationalised a period of peace and prosperity is likely to be established, during which public opinion will be transformed. Nations will still retain their political autonomy and control over their individual police forces, which will probably consist of militias since these are cheap and sufficient for maintaining law and order. Economically, however, nations will cease to exist as autonomous units, and should any one nation attempt to upset the balance of trade the mechanised forces of the great industrial powers will at once cross its frontiers and bring it to heel.

What is presented to us here is a return to the Prætorian system of Augustus; for though each of the greater industrial powers will possess its own mechanised army, the number of these powers cannot be other than small. It is not stretching the imagination too far to suppose that at some future date, perhaps only a hundred years hence, two alone will confront each other, for example: Great Britain and Germany, or Europe and Asia, or Europe and America. Should such a condition be established, then any serious difference between these two powers must end in a war which will be fought out for the financial Cæsarism of Europe or the world. Then, and only then, will a prolonged period of peace be established, its duration depending on the ability of the financial despotism to eliminate all causes of revolution. If this despotism, this oligarchy of bankers, follows in the footsteps of Rome, then its ultimate overthrow is assured. But should it in place learn from Rome, a lesson which the Cæsars were unable to learn, since they had no precedent to guide them, that morality is even more powerful than economics, then may Western Civilisation accomplish the dream of Alexander—the Conquest of the World. Not by force, but by industry and justice.

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DESPATCH OF AN EXPEDITIONARY FORCE—LONG SEA VOYAGE.

By Major S. D. Graham, M.C., R.A.

IN a recent lecture given by Major-General Sir Edmund Ironside at the Royal United Service Institution mention was made of an incident concerning the despatch of the British Expeditionary Force to France in August 1914, to illustrate the amount of unnoticed and meticulous staff work that was necessary in peace to produce a movement plan on which the Military Landing Staff could "go nap" when the time came. An attempt has been made in this article to prove the truth of the above statement, and to show how much more difficult is the problem of despatching an Expeditionary Force to a theatre of war, requiring a long sea voyage. We must remember that embarkation of the Expeditionary Force must always form the prelude to any war in which we shall be engaged, and it is most important that every effort should be made in peace to prevent the smallest chaos during this difficult period; made all the more difficult when we remember that there are only two embarkation staff officers in peace in the United Kingdom, and at present no courses of instruction exist for training any. Further the Embarkation Staff Officers and Military Landing Officers of the late war are gradually "fading away." And though the subject is not one to thrill the heart of the average officer, it is hoped that portions of this article may be remembered by some of the few who read it, and that realising the difficulties which must arise, they will co-operate in evolving these improvisations and "brain-waves" which are so essential a feature for lubricating the movement machine. Let us hope we shall not live to see another British Expeditionary Force being despatched across the Channel, but we may be called on to send one further afield, and that is a very different problem from the movement point of view, as is shown in the following table of comparison :—

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Comparison of the shipping problem for the Expeditionary Force in August 1914 and now.

1914.	PRESENT DAY.
(i) A definite problem.	(i) An indefinite problem until theatre of war is known.
(ii) A definite force with War Establishments and store tonnage programme laid down beforehand for all concerned.	(ii) Composition, War Establishments and store tonnage programme cannot be finally decided until theatre of war is known.
(iii) Short cross channel "shuttle" service in vessels whose capacities were known beforehand, which could be crowded for a few hours and became again available at frequent intervals for fresh loads, i.e., more resembling an entrainment than an embarkation.	(iii) Long sea voyage in ships of capacity unknown until the time comes; more space wanted for men and horses; and will not again become available for use for several weeks.
(iv) Railway time tables for conveyance of units from mobilisation stations to ports all worked out beforehand.	(iv) Railway time tables cannot be worked out until time and place of embarkation and accommodation on ship is known, i.e., not until after mobilisation.
(v) Capacity of port of disembarkation known.	(v) Ports of disembarkation not known beforehand.
(vi) Few M.T. and no Tanks, Dragons, etc.	(vi) An enormous increase in M.T. and heavy fighting vehicles requiring special loading facilities and special shipping.
(vii) Practically no fitting required to make ships suitable for the purpose.	(vii) An elaborate plan necessary for ensuring the fitting of ships in large numbers at short notice.

Enough has been said to show how different and more difficult is the present problem than the one that faced us in August 1914 for the move of the British Expeditionary Force to France. Before a satisfactory movement scheme can be prepared we require the following data :—

(i) A definite force to deal with.

(ii) Definite War Establishments for all units and Advanced Parties.

(iii) Order of priority in which every unit of the force is to land.

(iv) The date each unit will be available for embarkation, including Advanced Parties.

(v) Figures for the tonnage of supplies, ammunition and stores to be shipped for the first month, say, the ports from which they will be shipped and the amounts from each port.

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(vi) The overseas port or ports to which the Expeditionary Force is to proceed.
(vii) The number of Hospital ships that will be required.
(viii) A decision regarding the extent to which normal trade is to be interfered with at ship fitting yards, and ports of embarkation and disembarkation.

As I have said already, the theatre of war and the scale of operations envisaged will not be known for certain beforehand, but we can make a general movement plan which can be adapted to circumstances, and for the purposes of this article I will not consider any form of Combined Operations for a landing in the face of the enemy but merely a disembarkation at an organised port. The most important Department of State with which the War Office has to deal with regard to the provision of shipping is the Board of Trade, and the foundation of an excellent understanding between the two departments was laid by the late Director of Sea Transport, Board of Trade, Mr. A. E. Faulkner, C.B., C.B.E. On the Board of Trade falls the onus of requisitioning and fitting the shipping required for the Expeditionary Force. The types of ships which will be required may be divided into :—

(i) Troop ships for dismounted personnel, certain light M.T. vehicles, H.T. vehicles and a very few horses to drag the vehicles clear of the quay on disembarkation.
(ii) Horse ships for horses, personnel and H.T. vehicles.
(iii) M.T. ships for M.T. vehicles and conducting parties.
(iv) Store ships for supplies, ammunition and stores (including petrol).
(v) Hospital ships.

All these types of ships will have different speeds, hence the necessity for knowing the order of priority for the landing of units, that is presuming that the Force has not to be convoyed by the Navy. If the Navy is mobilising also, the Admiralty will also require large numbers of merchant ships for the "fringes of the fleet," and also a number of fitting yards; further we might not have strategic freedom in the selection of ports and the movement of ships between ports. But let us take the simplest case where the Navy is not mobilising and all we have to fear is possible air action or attack by small craft in the neighbourhood of the overseas port.

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From a census of the suitable shipping available at ports in the United Kingdom, the Board of Trade can arrive at an estimate of the number of ships of each class that will be required, how long it will take to fit them for their several roles and when they will be available for embarkation. When the time comes, suitable legal powers will be given to the Board of Trade to requisition shipping. This power cannot be obtained before war is declared and even if it could be obtained, the preparation of a fleet to carry the Expeditionary Force would, in all probability, constitute an act of war. Thus at the outset we must expect a certain amount of delay in the provision of shipping which cannot possibly be obviated.

Practically every ship that is requisitioned will require fitting. Many of the liners for carrying troops will require but little conversion. The M.T. ships will require accommodation to be made for the personnel but the chief work will be the fitting of Horse ships. In these days of the frozen meat trade, practically no cattle or horse carrying vessels exist, and the provision of the required number presents the biggest problem from the shipping point of view.

The above is not generally realised, as is shown by the remarks at the end of a lecture given recently by Major-General Hambro at the Royal United Service Institution. On that occasion an officer got up during the discussion and stated that he had been told that it was simpler to transport horses than M.T. by sea—obviously a tale for the Horse Marines. As far as I remember, the above was an argument against mechanisation, but I fear one that will not bear the smallest investigation. As the amount of fittings that will be required for these ships may not be forthcoming at short notice, certain stocks are held at various depots conveniently situated for rapid distribution to the fitting yards on mobilisation. Having requisitioned the shipping on mobilisation, the Board of Trade have to estimate the accommodation available on each ship for the various constituent parts of the Expeditionary Force, how long it will take to fit them and when each vessel will be ready for embarkation and at which port. On receipt of this information the War Office have to issue "Ship Allotments" showing the accommodation available and the units to embark in each vessel, and arrange the necessary railway services from mobilisation stations to ports.

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The amount of detailed and careful work required to accomplish the above without chaos and in time to give all concerned the necessary warning must be experienced to be realised. Cool heads and real co-operation are essential on the part of all, and for once we must suppress our natural prerogative for grousing until we are safely tossing at sea, when perhaps other interests may demand our attention until we find our sea legs. Included in the ship allotments are medical personnel and where necessary veterinary personnel for duty during the voyage. These are drawn from a special "pool" formed on mobilisation.

Another point in connection with the work of issuing embarkation orders is that in peace the staff at the War Office (Q.M.G.2.) barely suffices to do the work in connection with peace moves. This staff on mobilisation must be increased by personnel who may be a little rusty in the work or by novices, and it is work that requires a long apprenticeship to have it at one's finger tips, and very few officers and clerks are really conversant with the various in and outs and "snags" which may arise from what may seem quite a trivial detail to the inexperienced. Q.M.G.2's task at the beginning of any war will be a very stiff one.

It may be taken as an axiom that units should be embarked complete, as far as possible, but the size of the Expeditionary Force, the necessity for a prearranged scheme and the most economical use of the shipping facilities make it absolutely necessary to subdivide units. Firstly they are divided into (i) Mounted units and (ii) Dismounted units. Mounted units must again be sub-divided into (a) Mounted portion and (b) Lorries and drivers. Dismounted units are divided, roughly speaking, into :—

(a) Dismounted portion.
(b) M.T. portion.
(c) Horse parties.

A card index is kept of every unit showing its sub-division into the various shipping components, including Advanced Party, if any. All units, except M.T. portions, will move to the port by rail. Special arangements are made for M.T. and R.A.F. and notified to all concerned beforehand. As a rule all M.T. vehicles must proceed to the port and be embarked empty, the loads accompanying the personnel of the unit on rail and ship. Exceptions have

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to be made to this rule in the case of vehicles whose loads cannot be separated from them, such as Anti-Aircraft, Wireless and Workshop lorries. In these cases special arrangements have to be made for cranes or derricks of the necessary lifting power to deal with the loads. H.T. vehicles will invariably be embarked fully loaded with their units.

Ports of embarkation are selected in peace and a decision made concerning which of the components of the force (i.e., mounted, dismounted, M.T. and stores) shall be embarked at each. Some ports only deal with one portion, while some deal with several. Establishments are laid down for the embarkation staff for each port, and a mobilisation scheme for each is prepared by the Command in which it is situated.

Now a word regarding the preparation of the ships which, as I have said, is the province of the Board of Trade. A specification is laid down in peace giving in great detail the accommodation that is to be provided and the types of ships required. When war comes the ships are requisitioned and ordered to the fitting yards, to which are also sent the necessary quota of ship fittings mentioned above. As soon as fitting is completed, the ship is ordered to the selected port, fuelled, victualled and foraged by the shipowners, inspected and provided with a definite scale of stores, clothing and stationery and finally berthed ready for loading at the appointed time and place. An O.C. ship is appointed in each case by the Embarkation Commandant, who in turn selects a staff for the ship corresponding to the "permanent staff" provided in peace on the regular transport. Special instructions exist regarding passages for civilians such as members of the N.A.A.F.I., Red Cross organisations, etc. Special orders will also be necessary regarding explosives and inflammables. In the United Kingdom legal powers exist whereby harbour authorities can be forced to waive their normal peace time regulations concerning these matters, which are necessarily very strict, and bound up with their insurance policies. Greater difficulties arise at ports abroad and in some cases ships carrying such articles cannot enter the port without first unloading explosives and inflammables, which causes difficulties, not only at the port of disembarkation, but also at intermediate ports of call.

There are several ways in which the regimental officer can assist

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during embarkation. The most important is to remember that the Embarkation Staff Officer represents the Embarkation Commandant and is only carrying out the latter's orders. Any instructions from him must be carried out in the right spirit, and if it is realised that these instructions are the outcome of practical experience in the best way of doing things no friction should arise on this score. Strict discipline and a spirit of *esprit de corps* for the success of the embarkation as a whole are essential. Rapidity with an absence of noise and fuss are his province, and by rapidity is meant balanced, continuous and "disciplined" movement rather than haste and bustle. Civilian officials such as those of the Board of Trade, harbour authorities, foremen of stevedores, etc., should not be approached direct by regimental officers, or interfered with in the performance of their duties. It must also be remembered that these remarks apply equally to disembarkation, when it is imperative to clear everything from the quay as fast as it is practicable to do so. Docks are for transit purposes only, not for storage, even for short periods.

A memorandum entitled "Notes on Movement Staff Duties" was issued to Commands in 1927, and it is now being revised and many valuable lessons from Shanghai are being incorporated in it. It will then be published in pamphlet form and is well worth perusal, not only by the Embarkation Staff Officers and Railway Transport Officers, but by all officers. The pamphlet goes into the Embarkation Staff Officer's job in great detail. It is essentially a job that requires attention to details, specialised knowledge and familiarity with countless regulations.

This pamphlet should enable the M.L.O. to occupy his time during the voyage with the preparation of his scheme for disembarkation, allotment of duties to his staff, etc., and have a framework cut and dried as far as is possible without personal reconnaissance on the spot. The lack of such a publication was felt by the M.L.O. Shanghai Defence Force.

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MILITARY ADMINISTRATION IN THE PALESTINE CAMPAIGN.

By Lt.-Col. W. G. Lindsell, D.S.O., O.B.E., M.C., R.A.

EVERY theatre in which the various phases of the Great War were fought out presents its own particular lessons whether of tactics, strategy or administration. Administratively, however, the campaigns in Mesopotamia and Palestine provide by far the most interesting lessons for British officers. Though there is little doubt that the day will come when the British Army again goes to fight on the continent of Europe, it is more likely to go first to fight in some theatre of the Near or Middle East. Although the broad administrative lessons of the war in France and Flanders are applicable in their main principles to any theatre of operations; Palestine and Mesopotamia present conditions affecting the maintenance of an army in the field which were not present in Western Europe; these are the conditions we shall have to contend with in our future wars, and the lessons to be learnt from them are all the more worthy of our study.

In the Palestine Campaign deserts, morasses, hills, valleys, rocks and rugged mountains all had to be conquered; while climatic conditions included extremes of heat and cold, drought and torrential rain, and diseases such as malaria and ophthalmia were serious menaces to an army in the field. In talking of Palestine there is a natural tendency to be biblical, and conditions there prior to the war had not changed very greatly since biblical days. Ever since the chariots of Pharaoh "drave heavily" the going in Egypt and Sinai has been difficult. We read how the children of Israel were compelled to make bricks without straw, similarly the army in Palestine had to struggle against a shortage of many essentials, especially as regards transport. We know how great were the difficulties of Moses in providing food and water for the children of Israel in the desert. The methods employed during the war by the Q.M.G. in Egypt to contend with this difficulty were little less wonderful than those adopted by Moses many centuries ago. If, however, a simile from lighter literature is

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preferred it will be found in "Alice in Wonderland," for I am sure the D.A. & Q.M.G. at Kantara, just like the Walrus and the Carpenter must have, "Wept like anything to see such quantities of sand."

But to get back to the administrative lessons of the campaign! It is in this campaign, perhaps above all others included in the Great War, that we see the interdependence of tactics, strategy and administration and the preponderating influence of administrative considerations on the main plans of operations. Supply, in its widest sense, was a dominating factor throughout. Before discussing details in this connection it will be well to consider a few points of geography and topography which have an important bearing on the subject. In the first place we must remember that the Suez Canal itself has been cut through the desert and that it lies some 30 miles from the habitable part of Egypt. The towns on the banks of the canal—Port Said, Ismailia and Suez—are entirely dependent for their water supply on the Sweet Water Canal which brings them the water of the Nile from Cairo 100 miles away. Furthermore the canal ports were only connected to Egypt proper by a single line of railway, which was only doubled to Ismailia at the end of 1915. These facts had a considerable bearing on the question of the defence of Egypt and the canal in the earlier stages of the campaign.

As regards Sinai itself there were no roads for wheels anywhere, and water was very scanty except in winter. The armies of bygone days have used the northern coastal route to invade Egypt from time immemorial, as there are wells along it and water can be obtained by digging. The water, however, is both scanty and unpalatable, and does not suit the digestion of the modern European soldier—it is even too much for a railway engine's inside, and they declined to work on it. The line of communication offered by this coastal route is quite inadequate to maintain the needs of a modern army—these needs being so vast, so technical and so complicated in their nature in comparison with those of ancient days. To make Lord Allenby's subsequent campaign in Palestine possible, the Kantara base was a necessity, as was also the bridging of the desert by the broad gauge railway and the pipe line from the Sweet Water Canal to the frontier of Palestine.

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As regards Palestine itself once the Sinai deserts were crossed the few so-called roads were passable for all forms of mechanical transport until the rains came; then transport had to get along as best it could, sometimes taking days to perform journeys that should have been completed in hours. East of the Wadi Ghuzzee there was a belt of from 20 to 30 miles of cotton soil, which in wet weather becomes a bottomless quagmire, impassable equally by railway lines, camels or lorries, and diversions had to be made towards the edge of the sand country to avoid it.

The coast line of Palestine and Syria is badly provided with harbours. From Port Said to Alexandretta the only intermediate port worthy of the name is Beirut, it is the only port that will take a ship of even 2,000 to 3,000 tons; on much of the coast line there is a considerable surf.

As regards climate Palestine is notoriously malarious, and during the summer months localities such as the Jordan valley, the coastal plain, and the Vale of Esdraelon have the reputation of being barely habitable, even the hill country is by no means free. Very considerable organisation was necessary to compete with the problem presented by the mosquito and so long as the front remained comparatively stationary these efforts were most successful, but as soon as an advance took place into areas where anti-mosquito work had not been undertaken the daily sick rate rose from under 3 per cent. to over 5½ per cent. When the final advance took place the problem of dealing with 100,000 prisoners, of whom more than 20,000 were sick with malaria or influenza, presented enormous difficulties for the medical authorities. Typhus, enteric, cholera and ophthalmia which proved such enemies to Napoleon's troops in Egypt over 100 years ago, were, however, most successfully kept in check in our army. The incinerator and the disinfector certainly helped to win the war, and the inclusion of a Hygiene Section in our divisional organisation was not only justified but an absolute necessity.

These questions of geography, which have just been outlined, had very far reaching effects on the administrative organisation of the campaign, and they should be borne in mind when considering the lines of communication at the various stages. The campaign was started for the defence of Egypt with a main base at Alexandria;

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in these early stages the line of the canal was held by us. With the resources then available it was probably the only course possible for the time being. The Turk soon showed, however, that it was possible for him to cross the desert and attack the canal. This pointed to the necessity of establishing a line of defences further east, so that the canal itself might be immune from long range artillery fire. We were at the time acting purely on the defensive so a line of strong posts and almost continuous entrenchments was laid out some 8 to 10 miles east of and parallel to the canal. To make this possible and to maintain the troops in this line, roads, railways and pipe lines were built out from the canal from eight or nine points, with an immense amount of labour and expenditure of material. Hundreds of miles of wire roads were made by pegging down broad strips of wire netting across the sand, these were most successful for infantry, bicycles and Ford cars, though it was torn up immediately by mounted troops or ordinary touring cars.

The next step was the realisation that by occupying Romani we would hold the key to Sinai, owing to the existence of the wells at that point. By establishing a force there the long line of desert posts could be dispensed with. But to maintain a force at Romani sufficiently strong for its defence necessitated the building of a railway and the laying of a pipe line, as British troops could not live on the Romani well water. Luckily standard gauge railway was decided on, as the narrow gauge, had it been laid, would never have been able to meet the subsequent requirements of the Palestine Campaign. Our force was established at Romani. There the Turks attacked it and were defeated. Though the subsequent pursuit of the beaten Turk was brought to a standstill largely on account of exhaustion of our troops from lack of water, the battle marked the end of our purely defensive operations. From then on our object was no longer the defence of Egypt and the canal but the defeat of the Turkish Army. From the defensive we passed to a very aggressive and mobile offence. This necessitated an entire upheaval of our administrative arrangements. A main base at Alexandria could no longer compete with the situation—it had to be reconstituted partly at Port Said but mainly at Kantara. Kantara for the Palestine and Basra for the Mesopotamian cam-

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paign are two of the wonders of the war. Kantara at the beginning was a small village on the banks of the canal consisting of a few mud huts and a mosque; it grew into an important railway terminus with 40 miles of sidings, with wharves and cranes capable of dealing with an average of five ocean-going ships daily, it had 30 miles of first-class macadamised roads, vast depots for ordnance stores, supplies and engineer stores, also rest camps and depots for 120,000 men and thousands of animals. Here was established the main base for the Palestine force. The main ammunition base depot remained, however, at Alexandria, for the simple reason that it had got so dug in there in the early stages that it was subsequently impossible to move it with existing railway facilities. This was unfortunate and it did create difficulties especially in the subsequent advance in Palestine.

Through the Kantara base went such volumes of supplies daily as 120 tons of meat, 250 tons of biscuits, 300 head of sheep and goats, 1,700 tons of forage and 100,800 boxes of matches, to mention only a few items. The size of the base organisation required by a modern army is colossal, for it must be remembered that the force to be maintained in Palestine was, at its greatest, under 500,000 men of all colours and 160,000 animals.

Of all physical obstacles to the advance of an army deserts are probably the greatest. This arises of course from the water problem. Water was an ever present difficulty throughout the campaign. In summer operations were liable to be prejudiced by a lack of water, in winter by an excess. On many occasions heavy rain jeopardised the supply arrangements, by converting the so-called roads into seas of liquid mud, rendering them almost impassable and in places quite impassable for either camels or mechanical transport. In many cases, too, the amount of water to be found in a given area, or the amount that could be carried there by pipe, camel or lorry, determined the size and composition of the force that could be employed in that area. In the early stages of the defence of Egypt and the canal it was perfectly clear that the only real defence, a defence, too, which made a change to the offensive possible, was to occupy the water bearing country through which alone the Turks could advance. If it was denied to them they could not approach. Even in this area, however, it is doubt-

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ful whether European troops could have existed for long on such water as there was. To take a large force there meant a pipe line and a standard gauge railway. Thus we find that for the passage of the Sinai peninsula the rate of progress was entirely dependent on the rate of advance of the railway and of the pipe line.

Later on the necessity for the capture of Beersheba as a preliminary to the attack on Gaza was largely determined by the necessity of securing the Beersheba water supply. The soldier administrator loves talking about "ration strengths," "fighting strengths" and "bayonet strengths," but in Palestine it was "drinking strength" that mattered, and all sorts of adjustments in organisation and breaking up of formations were resorted to, in order to increase fire power without adding to drinking strength. As an instance of this there was the reinforcement of the mounted troops at Romani by the machine gun companies of the 53rd and 54th Divisions as there was not sufficient water there to maintain any more mounted troops. During the final advance it was generally possible to get enough water for the men to carry on with, but at many places the water was insufficient; even when water was found in sufficient quantities it was usually in wells and not on the surface; consequently if the machinery for working the wells was damaged, or a sufficiency of troughs was not available, the process of watering large numbers of animals was slow and difficult.

Water or the lack of it in fact dictated the policy of defence and offence, and often of organisation. The possibility of putting the policy into effect lay with the administrator and the engineer. Never since Sir John Forrest carried the waters of Perth, West Australia, 300 miles to the gold fields of Kalgoorlie, have such gigantic schemes of water pipe systems been installed across a desert as carried the waters of the Nile to the borders of Palestine. This water problem will face us in many places where we may find ourselves at war before so very long; no apology is necessary, therefore, for laying so much emphasis on its importance. The means used for competing with the problem in Palestine will have to be used again, and a study of them cannot fail to be useful in consequence.

Before the pipe line from Kantara was laid down and supplying water, the army had started on its march forward covering the rail-

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way construction parties and water had to be carried forward in trains of water tanks. These water trains were filled at special sidings, where 20 or more trucks could be dealt with simultaneously, and on arrival at railhead were emptied into a long row of canvas reservoirs laid beside the rails. Here small camel tanks, called fantasses, were filled up and these were carried forward by camel convoys for distribution to troops beyond railhead.

When the first section of the pipe line was completed a new water siding was provided and the railway was relieved of carrying water for the first stage and so on until water was finally pumped to railhead.

Once El Arish had been reached the army passed into a country where, within limits, the troops could be supplied with water from local resources, though considerable organisation was often necessary for improving watering facilities and in local storage and distribution. Many minor pipe systems were installed, and the railway became the chief consumer of the supply from the original pipe system, large camel water convoys being employed in certain areas for distribution to the troops. The Turks in their retreat might have made things much more difficult for us in the way of water than they actually did by destruction of wells and water-lifting appliances. In many cases wells had been prepared for demolition but the charges had been left unfired.

We may now leave the question of water supply and pass on to a consideration generally of the lines of communication. Our lines of communication at the best were never good, as we were depending in the main on a single line of railway, liable to interruption from sandstorms and washouts. In consequence every subsidiary method of transportation that could be used was exploited to the utmost. From an administrative point of view the success of the campaign was largely due to the intensive employment of small ships of between 2,000 and 3,000 tons, and the landing of supplies and ammunition as and when opportunity offered, by means of surf boats and beach landings. The coast of Palestine and Syria as already pointed out does not, however, lend itself readily to this form of communication. Beach landings were of course very largely dependent on the weather and were precarious in consequence. The submarine menace, too, made the protection

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of the sea line of communication by no means easy. Though sea lines of communication were precarious on account of weather and submarines, land lines were likewise dependent on weather. The railways suffered during the rain from washouts and in dry weather from sand storms, the railway engines could not use the well water on account of its salinity and like the men and animals were dependent on the pipe supply from Egypt.

To meet the interruptions which were liable at various stages on the line of communication all ships carrying supplies for beach landings had to be specially loaded so that any particular commodity could be got at quickly in the event of shortages arising from any interruption in land communication, and there were many anxious moments and cases of hand to mouth existence especially when a submarine made a lucky bag on the subsidiary sea line of communication. This campaign provides most interesting examples of various means of handling supplies between the base and the troops. As an example: In the final stage of the advance into Syria, the railway had been badly damaged by the Turks and many of the culverts destroyed, and when we came to Haifa we found the big bridge between that place and Damascus had been blown up. Supplies from Egypt were conveyed to Haifa by sea, thence by train from Haifa to the broken bridge, then by mechanical transport, or camel in wet weather, across to the railway line again, thence rail to Damascus, thence by mechanical transport, camel, and donkey in the hills to the troops. The number of times supplies of all natures had to be handled in transit added much to the difficulty of maintenance. In the final stages of the advance when supply by sea became possible to Haifa, Beirut, Tripoli and Alexandretta, as they successively came within the area occupied by the E.E.F., we find the curious, but thoroughly economical phenomenon of important ordnance stores, which had been collected in Palestine, being sent all the way down the line again to Kantara for shipment to Syrian ports; ordnance personnel being sent up to these ports as each new channel of supply was established. A similar policy was followed with the mobile workshops which had to be kept as near the troops as practicable.

The difficulties, however, were by no means all on our side if one examines the Turkish line of communication as it was in

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October 1917, it will be seen that the maintenance of their force in Southern Palestine was no mean problem. From their main base at Haidar Pasha opposite Constantinople they were dependent on a single line of railway 1275 miles long. This railway, in addition to maintaining the force in Palestine had also to carry all stores for Mesopotamia as far as Muslimie and also for the Hedjas force as far as Deraa. The Taurus and Amanus tunnels were at that time incomplete. It was not until October 9th, 1918, that the first broad gauge trains ran through the Taurus tunnel, and the first train to run direct from Constantinople to Aleppo arrived there only a few days before the city was occupied by our troops. Until these tunnels were completed everything had to be unloaded at the western end and transported over the hills by pack transport and motor lorry, or had to be reloaded into narrow gauge trucks pulled by engines driven by compressed air, and again reloaded at the eastern end of the tunnel. The Turks, too, were very short of rolling stock, and their engines were dependent on wood fuel which had to be collected en route. In order to save rolling stock reinforcements were often detrained at Rayak and marched from there to the front line, a distance of 250 miles.

Before leaving the question of the line of communication it will be well to summarise the main points in this connection, the first is:—

That our main communications were liable to interruption; and therefore every means had to be employed to use subsidiary communications as opportunity offered. This especially applies to the last two phases of the campaign, in which sea communications enabled operations to be extended to a degree that would otherwise have been impossible. The next point to notice is the extraordinary diversity of transport used in the campaign; partly due to the urgent demands of other theatres, and partly to local conditions of climate and terrain.

What lessons do we get out of all this for our future wars? There is the lesson of the necessity for establishing advanced bases as our line of communication extends, with their own sets of depots from which the continued maintenance of the fighting formations can be ensured during periods of interruption of the main line of communication. This we see done in the Palestine campaign when

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we had the main base at Kantara, and advanced bases as the rail-heads advanced at El Arish, Rafa, Deir-El-Belah, Ludd, Jerusalem, Haifa, Beirut. The establishment of these advanced depots takes time, it often means considerable railway construction, and the stocking of the depots requires much transport, these considerations will often decide the date by which further advance may be possible.

Now as regards the diversity of transport used. What ideas do we get in this connection, having in mind the ever increasing measure of mechanisation now being applied to our army? Since the war the tendency has been to eliminate animal transport and where possible to substitute mechanical transport. This is advisable for war in countries where sufficiently good road facilities exist, but we have not yet invented a mechanised camel, mule or donkey. Our liabilities are not confined to Western Europe, and the question is—will our new organisation meet all contingencies? At certain times of the year, yes: at other times, in certain theatres such as Palestine, Syria and Iraq, certainly no, for in the words of the song:—

"How in the world can the old folks tell,
It ain't a'goin' to rain no more"?

Our organisation should be sufficiently elastic to meet all possible contingencies. Is it? If we eliminate all animal transport we shall have no one trained in its management when the day comes to improvise it. Improvise it we certainly shall have to do in the future as we have done in the past. It has been said that we are past masters in the art of improvisation, but it will not be too easy to do by the light of nature unless we have peace time training in its management and some ideas as to how it has been organised in the past campaigns. Mechanical transport has already reached a stage in its development that it can go practically anywhere that horse-drawn transport can go, but it cannot always go where pack transport can go. Pack transport work requires study, knowledge, and practical experience if success is to be obtained. Where is this coming from when our army expands to a war footing? The 30-cwt. lorry of to-day is ideal for our purpose as a load-carrying vehicle, but it cannot go everywhere. If a lorry of smaller capacity were used we should intensify the difficulty of petrol supply; transport columns would be extended to undue length and the

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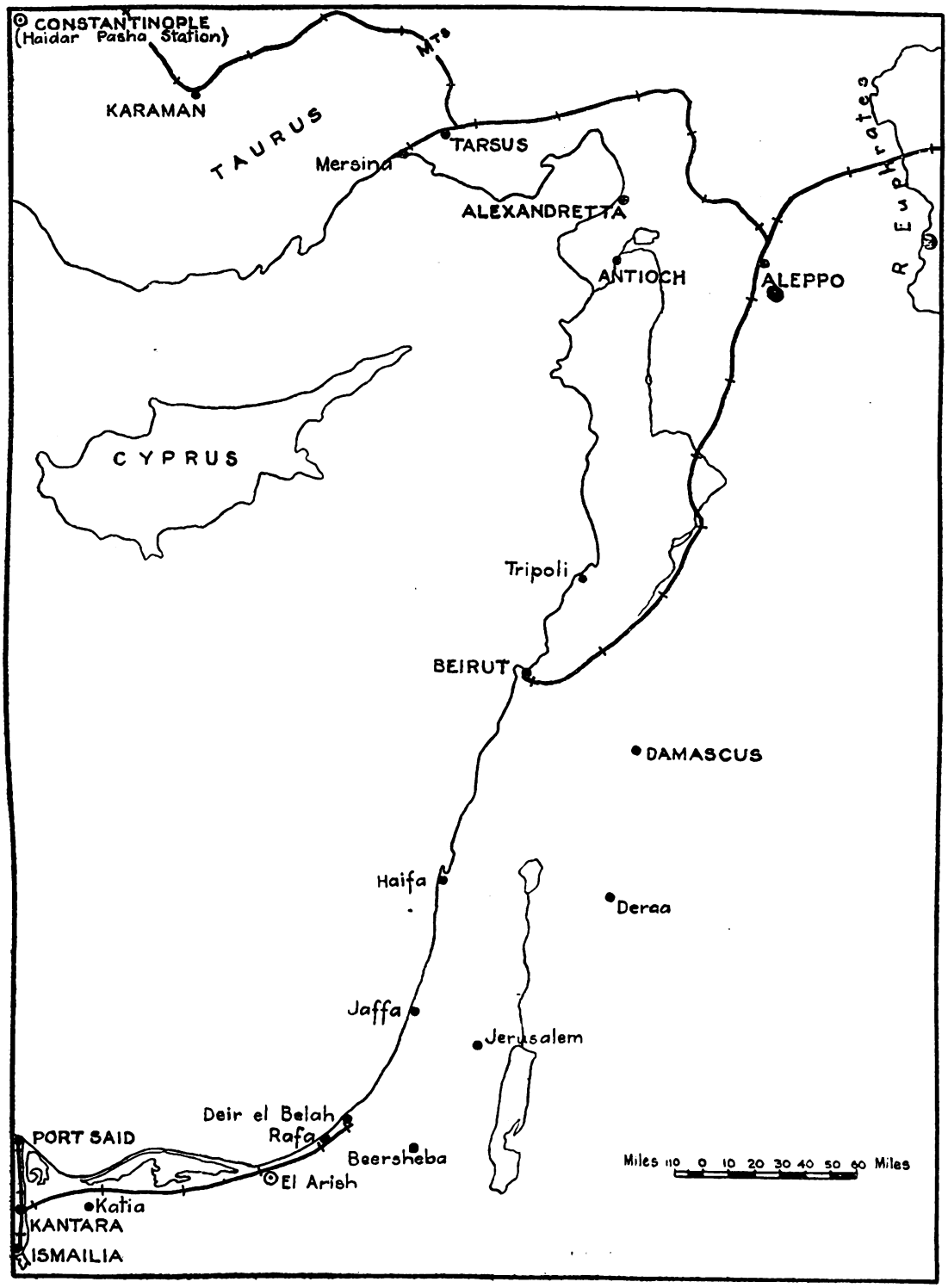

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number of vehicles in use would be multiplied, thus increasing the difficulties of providing drivers and spare parts and intensifying the problem of repair as well. Will our new organisation suit a war in China, on the N.E. or N.W. Frontier of India, or elsewhere in the Middle East? Remember always that the radius of action of a force in the field is limited by the possibility of maintenance. Distance and lack of transport facilities are the chief enemies in these countries and it is the administrative staff officer who has to overcome them.

One or two examples will serve to illustrate this point. The preparations for the first attack on Gaza are a case in point. By the middle of January 1917 our force had been collected at El Arish, but owing to lack of transport we were not able to advance much beyond that point. The available camels were barely sufficient for first line transport needs in the heavy sand, and the railway had not yet crossed the Wadi. It was necessary to build up a supply depot at El Arish, and to collect and organise second line transport before an advance was possible more than a day's march beyond railhead. Gaza was the objective but it was 50 miles away and therefore out of reach without transport. The decision was therefore made to advance on Gaza, when the railway reached Rafa. The country would then admit of the use of wheeled transport to a limited extent and the necessary supply echelons could then be formed to span the remaining 25 miles. At this time very little M.T. was available and the country where it could be employed had barely been reached. For the advance on Gaza first, second, and third line transport consisting of camels, limbered G.S. wagons, motor vans and lorries were collected and organised into fifteen train companies. Apart from the first line transport requirements the amount available only gave a total lift of 572 tons, an inadequate amount for a force of three divisions and two mounted divisions for even one day. The operation, therefore, had to be a one day show. The supply trains would admit of nothing more. If the coup did not come off the troops must withdraw to be within reach of food and ammunition. If successful there was water in Gaza and supplies could be landed from the sea. As is well known the attack was not successful and the force withdrew.

Similarly for the third battle of Gaza everything depended on

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water and the provision of sufficient transport. The standard gauge railway was carried across the Wadi Ghuzzee at Shellal, the units of the 21st Corps in front of Gaza were stripped of their divisional transport, and a pipe line was built from the Shellal reservoirs to the concentration area at Karms. By this means the 20th Corps and the Desert Mounted Corps were given sufficient transport to enable them to move out 20 miles from railhead. About 30,000 camels were utilised for the task. Subsequently the transport was turned over again to the 21st Corps for the pursuit, the 54th Division was stripped of all its transport and left behind in Gaza with a dump of supplies to keep them going, for the fewer the troops to be maintained beyond railhead the further they could go.

Many similar instances of makeshift transport arrangements and the dependence of tactics and strategy on administration can be quoted from this campaign, one more will suffice for illustration. In January 1918 the line Jerusalem—Jaffa had been gained, the Turk was beaten, why did Sir Edmund Allenby not push on at once? The answer lies largely in the administrative difficulties of the situation. Our railway at this date had reached a point about 15 miles south of Ludd, and it had not yet acquired great carrying capacity. The railway bridges between Jaffa and Jerusalem had been destroyed by the Turks and much repair work was necessary before this line could be used. To the task of maintaining the army was added the problem of feeding the civil population of Jerusalem, numbering about 80,000 over a difficult mountain road. With the transport available it was practically impossible to continue the advance until the line of communication in rear of the army had been organised and got into proper working order. The army had in fact outrun its communications, and a further advance was impracticable until the continued maintenance of the troops could be assured.

The instances quoted above are sufficient to show to what a very great extent the problems of supply and transport influenced the whole conduct of the campaign. One more difficulty which has already been mentioned calls for some further notice, that was the problem of dealing with the very large number of prisoners captured during the final stages of the advance. In some instances they were captured 50 to 60 miles in front of railhead, and they had

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to be marched down, watered and fed on the way until they reached their base destinations. There were between 80,000 and 100,000 to be dealt with and many of them were in a state of exhaustion or were actually medical cases which added to the difficulty. Camps and hospitals had to be provided for them. Concurrently with this came the influenza outbreak of 1918 which threw an unprecedented strain on the medical organisation, and on the ordnance service in providing the necessary accommodation for our own sick as well as for the prisoners of war. This is a type of difficulty we may meet with again in campaigns fought under somewhat similar conditions.

There is nothing really new in the administrative problems of the Palestine campaign. They were the same type of problem we have met before and will meet again. Owing to the demands of other theatres and the difficulties created by submarines there was always a shortage—everyone was producing bricks without straw—and nearly always the chief difficulty was lack of sufficient transport. It was the same really in other theatres, though possibly less so in France. It is the same old lesson over again that every war has taught from the beginning of time. The great strategical movements of armies have depended always upon their means of obtaining food and warlike supplies. Or as Napoleon put it :—

"Le secret de la Guerre est dans le secret des communications."

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AN AIR FORCE "SMALL WAR."

By Ubique.

EARLY in 1925 the Indian Government reluctantly decided that punitive measures against a certain section of the Mahsuds of the North-West Frontier were essential. The Political Officers had been unable to bring the tribesmen into a reasonable state of mind and further parley would only be taken as a sign of weakness, with possibly serious results. Under normal conditions an expedition amounting to at least a mixed brigade of troops would have been required to settle the matter, and though the object would probably have been attained without very heavy casualties, yet the cost in money would have been considerable. It was therefore decided that, as an experiment, the Royal Air Force should be called upon to force the tribesmen to submit to our demands without the assistance of ground troops in any way. This was admittedly asking the air arm to carry out a very difficult task, but the authorities were confident of their ability to accomplish all that was required, and welcomed the opportunity of demonstrating the effectiveness of the aeroplane as a weapon in frontier warfare.

Four squadrons and an extra flight (two squadrons D.H.9A Bombers and the remainder Bristol Fighters) were concentrated for the operations which commenced in March 1925 and continued for six weeks. The enemy were warned that after a certain date they would be liable to bombing and they were advised to move their women and children out of the tribal area. They did not take advantage of this suggestion, however, being confident of their safety among the numerous caves and nullahs of their own territory. Sentinels were posted to give warning of the approach of aircraft and the whole tribe took refuge in caves together with their cattle and movable belongings. The villages were abandoned and were soon destroyed by bombs, but in a country where mud is the chief building material this caused little loss to the Mahsuds. Attempts to burn the standing crops by means of incendiary bombs failed. The chief difficulty of the attackers, therefore, was to find suitable targets, and it was decided to maintain steady bombing with a view

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to keeping the enemy shut up in their caves. The greatest care was taken to avoid any definite routine, and by continually varying the time of attack and the type of bomb used, the tribesmen were always kept on the *qui vive* and never felt safe in venturing out of their hiding places. Bombs were dropped at the mouths of caves and near wells, and after giving the enemy twenty-four hours warning in writing, long delay-action bombs were also used. These latter bombs were timed to go off at varying periods up to twenty-four hours and by distributing them near wells and outside caves very considerable moral effect was produced. It was also discovered later that the Mahsuds treated all blinds as possible delay-action bombs. The attack was continued at night whenever possible and periods of desultory bombing were followed by "intensive days." The enemy's look-outs were outwitted, particularly at night, by the machines "making" their height over the aerodrome and gliding down towards their objectives with the engines shut off.

The bombs used were of four patterns, 230 lbs., 112 lbs., 20 lbs., and small incendiary. The last named were not found to be effective as the crops were not ripe and there were no other suitable targets, but the largest H.E. bombs gave excellent demolition results and their moral effect was considerable. The 112 lbs. bombs were also found to be satisfactory with delay action fuzes while the 20 pounders were chiefly used as sighting shots and for blocking the enemy in their caves. Steel darts, such as were sometimes used in France during the late war were not employed, though it is suggested that further experiments might be made with them against personnel in the open for future occasions. During the six weeks that operations lasted, over 150 tons of bombs were dropped and though these figures may seem small when compared to the results obtained on the Western Front in 1918, yet when the difficult flying conditions on the Frontier are taken into account, they represent a very creditable total. Gas bombs could doubtless have been used but their employment was forbidden as the enemy had no means of protecting his women and children against them and it was considered that gas was not a humane or legitimate weapon for Frontier warfare.

After six weeks continuous bombing, the enemy admitted defeat and complied with all the terms imposed by Government. It was

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then discovered that they had suffered surprisingly few casualties and they had continued their resistance so long in the hope that sooner or later some of the aeroplanes would come to grief and that the occupants would fall into their hands alive. They were confident that in this case the prisoners could be held as hostages and that the Government would remit the fines in return for their surrender safe and sound. Fortunately none of the attackers fell into the enemy's hands and only one machine crashed, and that was outside the bombed area, and in this case both pilot and observer were killed. When it is realised that in that exceedingly difficult country nearly 100,000 rounds of S.A.A. were fired at ground targets and that 2070 hours were spent in the air, the immunity from further accidents speaks well for the skill of the pilots and the efficiency of the mechanics. When the Mahsuds found that there appeared to be no likelihood of obtaining any prisoners with which to bargain, they soon tired of the acutely uncomfortable life they were forced to live in their caves and they decided to surrender. It was said that the deciding factor was—fleas. It seems difficult at first to believe that a Pathan would be affected by such a minor worry but there is no doubt that the refuges were in an extremely insanitary state after being greatly overcrowded for six weeks. The moral effect of the vigorous and unrelenting offensive was very considerable especially as they could make no effective reply. Perhaps the best testimony to the success of the whole operation was the fact that six other tribes in the vicinity, who had for many months failed to pay fines, surrendered at once and gave up rifles and money in order to avoid being bombed themselves.

The successful conclusion of the operation has vindicated the claim of the Royal Air Force to be able to undertake small offensives on the North-West Frontier without the aid of troops. With the advent of more up-to-date equipment this power will be increased and the suggestion has also been made that small airships might also be found effective for similar operations in future, though there are many technical difficulties to be overcome in addition to the usual financial objections. It is, however, in the question of finance that the R.A.F. may claim to have achieved their most spectacular success, for the whole cost of the expedition was probably not more than £50,000.

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ASTOR, LENOX, AND
TILDEN FOUNDATIONS

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A Renault Tank.

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INFANTRY AND TANKS.

Abstracted from an article by Colonel Velpry in the *Revue Militaire Française*, December, 1927. The photographs have been kindly supplied by *Les Archives Photographiques d'Art et d'Histoire*, Paris.

BY BRIG.-GENL. W. EVANS, C.M.G., D.S.O.

THE task of tanks is to destroy or neutralise the enemy's fire weapons with the sole object of allowing the infantry—the arm which actually takes possession of the ground—to advance. Any action by tanks is useless unless capable of immediate exploitation by infantry, as neutralisation of the enemy's weapons can only be temporary. Hence the need for close co-operation between the two arms.

It is quite clear that the tank's capability of advancing through the hail of bullets that stops infantry, makes it impossible for the two arms to fight side by side. This raises the question of how they are to keep touch and how they can best be trained in peace to co-operate in war. The efficiency of their co-operation will depend on :—

(1) Orders given to the tanks by the infantry commanders employing them;

(2) Tactical knowledge of the commanders of tank units, whereby they will know how to act in the best interests of their infantry.

An infantry battalion commander's orders to his tanks will usually define successive objectives, taking into consideration the ground and what he knows of the enemy. The best way of preventing tanks from losing touch with their infantry by going on and fighting on their own account is to fix these objectives comparatively close together. Until they have brought their infantry onto one objective, they must not go on to the next. Thus direct touch will occur frequently.

The configuration of the ground will generally determine the number of successive objectives, as on this depends the number of glacis swept by the enemy's fire weapons in position, and therefore it will also determine the distance by which tanks must precede the

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infantry to enable them to cross these glacis. Naturally crest lines must not be selected as limits of a bound, as tanks are too visible and easy to range on.

The presence of tanks should in no way change infantry tactics. What determines the movement of infantry is the volume of the enemy's fire. So long as this does not prevent movement altogether, infantry should move forward using suitable formation. When forced to halt they should make full use of their weapons to try and overcome the hostile fire and watch for the moment when a lull will enable them to move forward again. It is quite immaterial whether this lull has been produced by their own fire, or by the action of tanks, or that of artillery.

During the war, when tanks were first employed a scheme was devised for tank crews to put up signals to show the infantry that they had cleared the ground, and that the latter had only to come on to make it good. No scheme could have been better calculated to give a wrong idea of the combined action of infantry and tanks. It gave the infantry the impression that all they had to do was to look on at the tank fight until a welcome signal indicated that they could advance without having to use their weapons. It made the tank crews imagine that because they had cleared trenches they had come on, and killed groups of men, they were justified in signalling all clear when they might have been unaware of the presence of the most dangerous weapons of all: those to a flank outside the radius of their action and which had remained silent during their advance.

Infantry must judge for themselves when the enemy's fire dies down, and that is their signal to advance. They therefore must be taught that when they are working with tanks they must on no account regard themselves as mere spectators of a tank fight where they have only to await the issue to advance without loss. Without changing their fighting methods in any way infantry must endeavour to overcome the enemy they and the tanks are attacking by the full use of their own means—fire and manœuvre.

Battle tactics of tank section.

The duty of tank sections is to clear the ground in front of infantry. The section moves on the first objective deployed on

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a front of about 200 yards. It carries out the lateral movements necessary to seek out and destroy fire weapons distributed over the area. The section commander frequently watches his infantry because it is their progress that shows him if he is succeeding in his task. If when he is approaching the limit of a "bound" he sees the infantry are pinned to the ground, he knows he has not completed his task. In this case he must go back over the ground again, and if this fails must go back to the infantry and find out if they can tell him where the fire is coming from that is holding them up.

Now enemy fire weapons are extremely difficult to locate except in absolutely bare ground. The reports of tank section commanders during the war go to prove that quite low crops or scrub made their tasks very difficult. Tank crews can see very little, and machine guns with flash concealers making use of irregularities in the ground are difficult enough for observers in the open to locate, consequently much more so for men in moving machines looking out of narrow slits. When cover is thick the intervals between tanks must be close to prevent the enemy slipping through and to enable individual tanks to help each other. This will lengthen the time necessary for a section to thoroughly search the area behind a given width of front.

Training infantry with tanks.

In peace training the liaison between tanks and infantry is difficult to teach because of the absence of the enemy's fire which is the factor that determines the progress of the infantry. It would be a great help if some scheme were devised for representing the fall of the enemy's bullets. Then instead of infantry following up tanks merely because they had got a given distance ahead, they could be given an indication of that slackening in the hostile fire which gives them the opportunity of advancing.[1]

With such a representation of fire effect, exercises practised first without and then with tanks will show the infantry that the presence of tanks in nowise alters infantry tactics. It is no excuse for the slackening of a resolute offensive, but by shortening the

[1] General Passaga had some such arrangement for infantry training and Colonel Velpry regrets that it, or something on those lines should not be more generally used.

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critical periods when infantry are immobilised, it gives them a chance of getting on more quickly and therefore with less loss.

In the war co-operation between good troops and well-trained tank units did not prove difficult. Troops who had never worked with tanks met with brilliant successes simply because, with or without tanks, they were determined to join issue with the enemy, and so were ready to make the best use of the opportunities tanks gave them to get forward.

Organisation.

The section should not be the fighting unit, as it is not self-contained and therefore is incapable of sustained action. If all three sections are deployed on a wide front the company commander's work becomes impossible. If too wide a front is allotted to a section, it has to spread out to search for machine guns. This takes time, so not only will the infantry be held up, but the enemy will be able to get his artillery onto the tanks, and to get all his anti-tank weapons into action. All this points to the allotment of more than one section to a battalion front. Experience of the war shows that the employment of single sections of tanks led to failure.

It is sometimes argued that when a battalion attacks on a front of 800—1000 yards, its main effort will be on a key point, and that this point is where the tank section should direct its effort and therefore undue dispersion will not occur. There may be some truth in this, but the enemy's fire weapons will not all be in the zone selected for the main infantry attack, and machine guns on the flanks are a source of great danger. A position is not merely held by riflemen firing straight to their front, so tanks cannot direct their action against any one point, but must deal with the flanks as well as the front of attack. This is why isolated actions by single sections were usually failures. During the first fortnight of June, 1918, nine isolated actions were fought by sections of the 501st Regiment of Tanks in the defence of the Forest of Retz. On each occasion machine guns were captured and the enemy driven back, but in spite of this the infantry were unable to make sensible progress or even to occupy the part of the enemy's line cleared. Fire from machine guns from the flanks proved to be the stumbling block in all cases.

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On each of the five occasions during this period when at least a company of tanks was put in and left no gaps in the front cleared, the infantry were always able to advance and reach their objectives. It is true that economy of force is always desirable, but tanks being impervious to small arm fire the truest economy is to use them in sufficient numbers to enable them to carry out their task completely and quickly. Tanks cannot be compared with infantry in this respect. In the case of the latter increasing the number engaged may have the result of increasing their losses without adding appreciably to their offensive power.

EXAMPLES.

In the beginning of June, 1918, the enemy was exploiting his break through at the Chemin des Dames, and was attempting principally to extend his success towards the valley of the Oise. On May 31st a counter-stroke by a battalion of tanks supporting the Maroccan Division checked for the time being his advance along the plateaux south of Soissons. The following days the enemy attacked more strongly from the south in the Villers-Cotterets region. The two other battalions of the same regiment of tanks were deployed on June 1st to support troops who were falling back on the forest of Retz. These were new battalions and had never been in action. One of them was placed at the disposal of the 8th Infantry Regiment who were holding the approaches to the forest near Vertefeuille Fm. (11 km. N.E. of Villers-Cotterets, on the Soissons road).

The tank companies thanks to the cover of the woods were close to the line and capable of almost immediate action. The following reports of the battalion and section commanders describe the fight. (See Sketch I.)

Battalion commander's report.

(1) On June 3 about 1100 hrs. numerous bodies of Germans were reported to be approaching Vertefeuille Fm. and its approaches north and south . . . . At 1730 hrs. the position was taken by an enemy battalion with other troops in support. The Germans had thus gained a footing astride the Soissons—Villers-Cotterets road which would enable them to dribble men into the forest.

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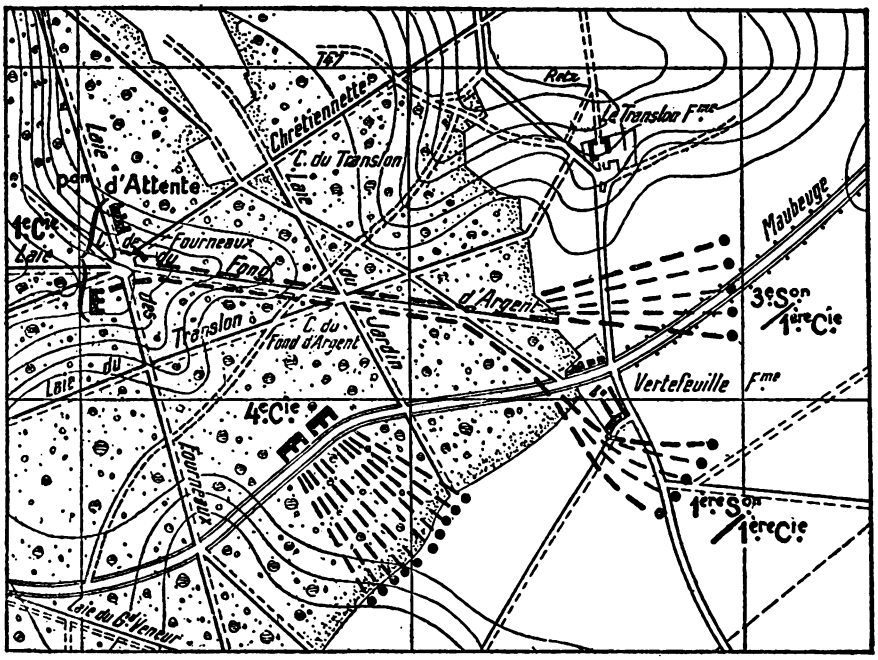

SKETCH NO. I.

(2) *Nature of the fight.* The 1st and 3rd sections of No. 1 Company were placed at the disposal of the O.C. 1st Battln. 8th R.I. The ground was favourable for a tank attack on both sides of the farm. The forest had as yet been little shelled and favoured the approach of tanks. The commandant proposed to use the tanks with the support of *one section of infantry* as follows:—The 1st section were to proceed to the south of the farm; 3rd section north; the infantry to occupy the farm while the sections established themselves 200 m. beyond. Orders to attack were given at 1800 hrs. At 1830 hrs. the tanks left the forest, at 1900 hrs. they had gained their objectives; at 1930 hrs. they were brought back to their jumping off place in the wood.

(3) *Results.* Vertefeuille Fm. and its approaches were retaken in 50 minutes with 28 prisoners; . . . . the Germans lost heavily, the tanks having been able to fire on numerous groups. "A German questioned by me yesterday (a medical student) said he had seen 25 men killed or wounded by two tanks."

(4) *Casualties.* Two men wounded by bullets through observation slits. (Signed—Comdg. 1st Battln.)

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Section Commanders' Reports.

"*1st Section.* The section arrived at the farm in column of route following the track that debouches west of the farm. We crossed the Soissons road in column of half sections, but formed column of route again on account of the thick undergrowth south of the road until reaching the edge of the wood, whence we moved east deployed. The surprised Germans received us at first with machine-gun fire. A bullet came through the left visor of my tank and wounded my mechanic in the shoulder. The section by this time deployed opened fire on the enemy who ran away panic-stricken. The tanks followed them up and killed a large number. We halted 400 m. from the farm and then fell back, turning the farm by the left, and inflicted heavy casualties on the Boches as they fled from the farm. Meanwhile the infantry occupied the farm and the section returned by the same route as the 3rd section.

3rd Section. The section debouched from the wood where the Four d'Argent ride leaves it. The section moved forward slightly in echelon parallel to the edge of the wood. The right half-section came opposite the farm buildings north of the road—it was received with heavy machine gun fire which it quickly reduced. The left half-section with section commander's tank reached the Vertefeuille—Trauslon road and proceeded east, the section commander's tank reached the national road and these took in enfilade numerous machine guns echelonned along the road. The right half-section pursued the enemy south of the road and got into touch with No. 1 section south of the farm. The enemy having fled the infantry occupied the farm and we returned by the Four d'Argent ride in column."

It should be added to make the picture complete that two sections of another tank company with a detachment of the same infantry battalion, made a simultaneous attack in the forest to the south in the vicinity of the farm. Their orders were to drive the enemy to the edge only and they did not go further. For this reason, the section commanders' reports are less interesting.

This small operation has been gone into at length as it is typical:—

(1) On account of the surprise and panic produced by the unexpected appearance of tanks amongst troops whose moral

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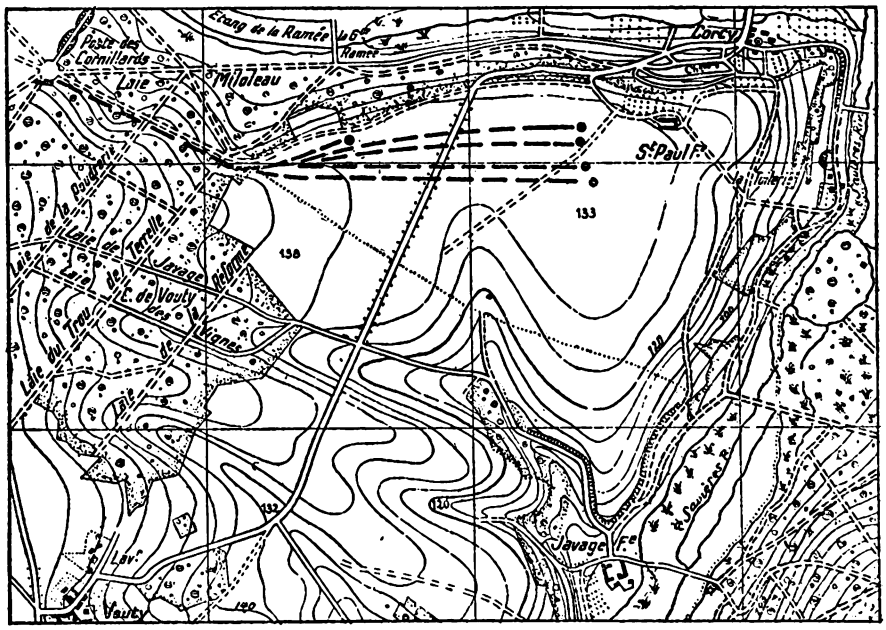
was heightened by their previous success. Before they could pull themselves together the combined envelopment by the two sections of tanks from north and south of the strong point attacked, immediately crushed any attempt at resistance and put them to flight.

(2) The high percentage of tanks used to support a small body of infantry. The allotment of four sections of tanks to less than one company of infantry led to a success very quickly obtained with a minimum of casualties. This, of course, is an extreme case. Such a small body of infantry could not have gone far; indeed there were barely enough to hold the ground won; the example was chosen to show how it pays to make full use of the tanks available irrespective of the number of infantry employed.

The following is an example of a failure owing to the fact that sufficient tanks were not used. On the 2nd June an affair took place 6 km. further south. The reports of the tank company and section commanders will make it clear what happened. (See Sketch II.)



SKETCH NO. II.

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Report of Captain commanding 8th Company.

(1) On June 2nd at 4.30 hrs. Group "M" will carry out the counter-attack ordered, taking as objectives from Fme. Saint-Paul to Fme. Javage. O.C. counter-attack will endeavour to gain the wooded slopes immediately west of the Savieres to give the tanks time to clear the plateau south of the belt of wood west of Corcy. If he thinks the situation allows it he will occupy as strong points Javage—Fme. Saint-Paul and the spinneys between them.

If the situation should not admit of this he will remain there the minimum time required by the tank commander to allow of the withdrawal of the tanks at the end of the operation.

Thus a situation will be created enabling him to obtain the closest observation of the head of the ravine debouching from Javage and Fme. St. Paul.

(2) *Tasks of tanks.* (a) To debouch from the side S.E. of Cornillards and cover the advance of the 2nd company on the plateau of Corcy. (b) To clear the Savieres ravine south of Corcy.

(3) *Report on the engagement.*

On June 2 at 2.10 hrs. the 1st section of No. 8 company left the rendezvous. Here follows the section commander's report.

"At 4 hrs. the section left the cover of the wood and deployed; during this operation my m.g. tank of the left half-section fell into a shell crater where it remained helpless. The section preceded L——'s company of the 167th Regiment and advanced on Fm. St. Paul. The enemy's advanced position on the high ground on the Corcy—Vouty road was taken in the first rush and an officer and five men taken prisoner.

This first objective being taken I got into touch with the infantry and was informed by a sub-lieutenant commanding a section that they had decided to push on, taking as their objective Fm. St. Paul which they would endeavour to hold. The advance was recommenced at once, the infantry following up close to the tanks. Two machine guns were fairly quickly neutralised on the crest and the infantry at once crossed it but were held up about 100 yards from some straw ricks south-west of Fm. St. Paul. Numerous machine guns hidden in a field of rye south-west of the farm prevented the infantry from making any further advance. The tanks went on

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and one of the machine guns in the straw ricks was destroyed by my tank . . . . The other machine guns firing on us out of the rye field could not be located and tanks had to guess where to shoot. The enemy became very bold, one man actually climbed up onto Q.M.S. Lesourd's tank and shot him twice with a pistol. As we were quite unable to locate the machine guns which had opened a hot fire on the tanks, I got into touch with the infantry who were lying down about 200 yards behind, and then was told that they had decided to make no further advance, as they had gone beyond the first objective."

In this case the tanks failed in their task; the infantry failed to reach its objective; true, it had pushed back a small advanced post, but directly it passed the crest it came up against serious resistance and was pinned to the ground and the action of the tanks did not lead to any further progress being made.

The tanks engaged with enemy machine guns came off second best. There were too few of them to get the upper hand. If, instead of a section the captain had put in his whole company a result would have been achieved that day instead of a day later; for the enemy having made still further progress on the 2nd a new counter-attack was launched on June 3rd over the same ground by the same battalion. This time a whole company of tanks was employed, and the enemy was driven back from the edge of the wood to the banks of the Savieres.

To summarise the lessons to be drawn from many examples similar to the two selected: To make even a local attack hostile fire must be neutralised on a wider front than can be undertaken by a section of tanks. By employing several sections, even though it were possible for one section to carry out the task slowly and meticulously, success is much more quickly obtained and therefore with less loss to infantry and tanks; this is true economy. Combined action by sections of the same company gives an opportunity for manœuvre most favourable to the quick reduction of hostile resistance.

A company of tanks should be the normal allotment to an infantry battalion in open warfare.

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RENAULT TANKS NEAR ST. JEAN, YPRES.

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In the fight the tank company commander should be with the battalion commander and under the same condition of subordination as the machine-gun company commander; he has the same limits of initiative. This is a very good plan as it simplifies the battalion commander's task, by giving him a definite line as to how to employ units, which are often allotted to him at the last moment.

The *company* being the tank unit usually employed on a battalion front, the infantry division attacking should have one company for each battalion zone considered suitable for the use of tanks. A *battalion* of tanks with its three combat companies ought to be enough, because if the division attacks on a wider than a three battalion front its effort is likely to lack in vigour; and tanks should not be employed unless an attack is pushed home.

Disposition of tanks in depth.

This is rendered necessary so as to replace casualties in the front line and provide reserves to meet the necessities arising from the development of the attack. The first question to ask oneself is: "How long can companies in the front line in an attack carry on?" A company of light tanks was able to put up a good fight for two consecutive days, in the most severe battles of the war; after that casualties and fatigue made it necessary to withdraw it for the moment. It must be remembered that two days' fighting means more than 48 hours of uninterrupted work for the crews. In addition to bodily weariness and nerve-strain are added whole nights employed in greasing, cleaning, filling up with water, spirit, ammunition; removal of tanks temporarily immobilised but capable of further effort; finally getting into position to start the attack next day. After these two consecutive fighting days, a halt is necessary to rest the men, carry out urgent repairs, and when casualties have been heavy, to reform companies by amalgamating what tanks remain. This halt would be for 1, 2, or 3 days, according to the severity of losses incurred.

If it is agreed that a company can fight two days running, then:

(1) A larger number of tanks should not be allotted to a division than is necessary for a front such as we have indicated, as they can carry on long enough to give the higher command time to produce fresh means to continue the fight if necessary.

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(2) The division attacking should make full use of its tank companies without considering disposition in depth.

The tendency of units to keep tanks in reserve should be combated as the first consideration is to assure the success of the first onset. The first half hour is more decisive in a tank attack than in any other. The surprise, confusion and panic caused by the unexpected sight of a mass of tanks are the main elements of success. This must be at once followed up by a rapid advance sweeping away all efforts at resistance. To obtain this result a good proportion of tanks should be used. Even if there are more than necessary the advance will only go the quicker for it and consequently with fewer casualties in men and tanks.

When on the other hand enough tanks are not put in, the action becomes prolonged, gives the enemy the chance of pulling himself together and using his defensive methods. Defensive weapons exist in sufficient numbers; but as artillery is one of their main features, it takes time to obtain its co-operation. If you give the enemy this time, the operation must be a failure and tanks kept in reserve will not restore the situation. Immediate success is more important to tanks than to any other branch and faulty initial dispositions cause immediate and irreparable failure.

(3) Tank units of the second echelon belong to Corps and Armies.

As a Corps deals with a zone organised in depth and therefore demanding a prolonged effort, a second echelon of tanks should be allotted just as is a second echelon of divisions. It is necessary to allot them early to enable reconnaissances to be carried out, liaisons established between commanders; in a word all arrangements made to ensure the pressure on the enemy being continued without interruption.

The Army disposes of its tank units according to the successive manœuvres necessitated by its plan of battle. It first allots to the corps making the main attack all the tanks needed to ensure success. In the development of the action the army commander will allot to a corps whose task may have increased in importance, tanks from his reserve and from other corps whose role has become less important. So the allotment of tank units on the army front will be constantly variable; tanks are such a valuable aid to manœuvre

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that the higher command must use them to suit the various phases of the battle, and must pay the very strictest attention to economy of force, as tank formations are very quickly used up, and they are relatively few in number. This means that where it is necessary to allot many tanks to some of the higher formations, they must often be altogether withdrawn from others who are playing a minor part in operations.

To sum up, fighting formations up to the division need not consider the question of tank reserves. The high command allots them what they require for the operation in hand. They should make the fullest use of them. It is for the Army and the Army Corps to reserve what they require to support the development of operations.

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SOME GERMAN VIEWS OF ARTILLERY.

Translated by COLONEL H. ROWAN-ROBINSON, C.M.G., D.S.O.

A technical survey. By Colonel Blümner. *Militär Wochenblatt*, 1928, No. 29.

GERMANY declined to accede to the demand which was prevalent before the war for a combined gun for the field artillery, and introduced the light field howitzer. The same demand arose during the war and led to the institution of experiments with the "Rhein-Metall" gun-howitzer. The matter is still very much discussed both in Germany and other countries. In Germany many war-gunners believed from their experience of position warfare that the field howitzer with its range extended to 12 km. would meet all the demands of the field artillery. General Muther who was chief of the field artillery department in the war office during the war disagreed after seeing the trials of a combined weapon of 9c/m. In the present army the opinion is strongly held that the field artillery needs two different weapons: the gun with its long range and the howitzer with its curved trajectory and high shell power. Only in the carriage would combination be sought. I consider this the best solution for the war of the future, but I should like the calibre increased to 8·5c/m in order to obtain greater range and more effect.

In France the same discussion rages. Colonel Rimailho, the well-known gun constructor of the St. Chamond factory, is in favour of a combined weapon of 9c/m. General Herr, on the other hand, who was Inspector General of the French artillery in the war, in his book "The artillery in past, present and future," asks for a 7·5c/m gun with a range of 14 km. and for a field howitzer of 10c/m with a range of 12 km. In the "Revue d'Artillerie" Lt.-Col. Buchalet recommends as a weapon for all purposes an 8·5c/m howitzer with a range of 9 km.

Not long ago Schneider (Creusot) manufactured a gun-howitzer of 8·5c/m calibre which had considerable range and a variable air spacing. For the flat trajectory a long thin 10 kg. projectile is employed which has a thin gas ring and can be pushed far into the

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bore. The normal charge used in this large chamber gives a range of 14 km. and the special charge 15 km. The other shell with its thicker gas ring makes a smaller chamber in which charges of various weights are used. It weighs 8·8 kg. and has a maximum range of 9·8 km.

This weapon exhibits many novelties and advantages, such as muzzle-brake, short recoil, compensation and split-trail, but it has a weight in action of 39 cwt. which is much too heavy. Moreover the gun has to be drawn back to a special position on the carriage when on the line of march. It is specially designed for mechanical transport; with horse-transport the detachment and gun stores do not accompany the gun. The very high pressures developed by the larger charges reduce the life of the gun. On the other hand the inner tube can be changed in the field. If France were to accept this gun she would clearly have to accept many drawbacks with it, of which perhaps the most important is that in spite of abandoning shrapnel, two natures of shell would still be necessary.

Here we come to the question of the universal projectile round which discussion used to rage. Shrapnel, which had such a high reputation prior to 1914, was almost given up during the long period of position warfare; and only the knowledge that in future there will be wars of movement has prevented it from falling entirely into disuse. Field artilleries that entered the war with 50% of shrapnel finished it with 10% to 15%, the United States and Japan having slightly higher proportions.

In the *R.A. Journal* an attempt was made recently to show that shrapnel is still the most valuable projectile. We prefer General Herr's judgment that the use of shrapnel will be limited to guns of small and medium calibre and to ranges of under 15 km. It is naturally inferior to H.E. at all times against shielded artillery and tanks and against troops in woods and villages.

Carraciolo asks in the *Rivista di Artilleria e Generale* that 10% of shell shall have various kinds of coloured smoke so as to distinguish separate batteries in concentration of fire. The ranging of batteries must of course be observed somehow or other either from ground or air if the shooting is to be effective. The suggestion therefore is sound enough, and it was also made in the war. The German artillery then used yellow and red colours, the latter

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especially for flat trajectory guns. They did not prove satisfactory, however, and it would still be difficult to introduce them without detriment to the ballistic qualities of the shell.

No 35, 1928.

The armament of the artillery in the infantry division.

Under this title a controversy has arisen in the *Revue d'artillerie*, July/Sept., 1927, and *France Militaire*, 10/27, between F. Lartier and writers with *noms de plumes* of *Fajo* and *Bello*, in which the most various and divergent opinions are expressed with reference to the well-known article by Major Voight-Ruschewevh on corps artillery published in the *Artilleristicher Rundschau* (April/June, 1927). The most striking point is that the question of a combined gun-howitzer forms the kernel of the discussion in all these essays: whether there shall be one universal weapon; and if so, whether it shall be a gun or a howitzer or a mixture of both; and in the last case how shall the weapons be proportioned in the mixture. Simultaneously with this discussion the well-known French factory Schneider has produced a gun-howitzer that is being so much talked about and praised that it may be presumed that the French war office has already refused it.

The question is, however, so interesting that it is worth a further examination. There is no doubt that a combined weapon that could solve all the tasks of the divisional artillery would be ideal from the point of view of organisation and supply and would be of great tactical value. But, unfortunately, the realisation of this ideal is impossible if we are to meet the requirements of the modern battlefield; for it has all the usual drawbacks of a compromise. The never-ending conflict between power and mobility creates incompatible antitheses. It is certain that modern infantry, in combat against the heavy weapons of the opposing infantry, will more than ever need artillery of a high order of mobility to fight shoulder to shoulder with them. Here their mobility is the most important matter. As regards calibre no great reduction can be made if there is to be sufficient shell effect; hence mobility can only be obtained by a decrease in range. In the infantry zone there is no objection to this, because we are only concerned with relatively short ranges. Infantry batteries must therefore be created which

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combine great mobility with the necessary shell-power. This arm takes over the chief task of the former field artillery. The nature of draught will not be discussed here; but stress may be laid on the point that the motor will not in principle seriously alter matters; for, apart from the great weight of a motor-carriage, every ounce must be saved with the mechanised gun in order to be able to carry a sufficient quantity of ammunition. Here again we need small but sufficient calibre, high mobility and low draught. There is no doubt that, to meet modern conditions within a division, power and mobility must be separated, mobility taking a forward place, power being echelonned backwards, the former embodied in the artillery with the infantry (anti-tank guns and infantry batteries, trench mortars and special guns of accompaniment), the latter embodied in the field guns and howitzers of the divisional artillery. Moreover the tasks of the artillery must undergo the same separation. The infantry batteries take over the tasks of the former field-artillery; the divisional artillery has counter-battery work as its chief task and strengthens the fire of the infantry guns at important and dangerous places and in order to gain a decision; that is to say it only supports the infantry occasionally and under special conditions. There is no doubt that this state of affairs demands an increase in the total artillery employed. Again, as regards control, a new staff must be created for the infantry batteries, which must be under the command of the infantry brigadier and yet in the closest touch with the commander of the divisional artillery, under whom it may come in special circumstances such as concentration of fire to cover a defensive position.

Looking at matters in this light, there is a possibility of central control only inside the divisional artillery. In achieving this one of two methods must be tried. Either equipment with the light field howitzer with a somewhat increased range, a curved trajectory being needed for combating enemy artillery and destroying cover, in which case long range work would have to be taken over by the heavy guns; or there will have to be two light howitzer batteries and one long-ranging gun battery in each field brigade. In the latter plan there would then always be some long-range fire in the division, a considerable advantage as heavy artillery is not always available in sufficient quantity, and its long-ranging guns

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are generally allotted to special tasks. Heavy guns are out of place in a division partly because of their weight and partly because the duality of their work handicaps their readiness for action. If a compromise were to be made by reducing the calibre of the latter and a mixed brigade introduced with weapons of about 9c/m calibre, there would be a loss of penetration, a serious weakness dealing with modern means of protection. A gun-howitzer, moreover, has never the necessary range for distant targets. This is a quality urgently needed because artillery must endeavour to bring effective fire on to massed troops before they deploy, otherwise they lose their best chance of causing loss, effect against troops scattered in the open being naturally of a low order. If, in spite of all these drawbacks, it should be decided to have a combined gun-howitzer in order to facilitate ammunition supply, then we must anticipate fire upon our columns to which we cannot reply, an experience no troops will stand for long.

Organisation of the artillery of a division. By Maj.-Genl. von Amann. No. 39, 1928.

Since artillery appeared on the battlefield with a large number of guns, two points have become of particular importance with regard to its distribution: the one that the infantry must everywhere be given moral and material support; the other that, especially since Napoleon's days, decisive success is most surely obtained by the concentration of artillery masses. This last point became still more important when rifling increased the range of guns. The employment of artillery in mass established in 1870 was kept up till the Great War. During the long war of position, there was a natural inclination to centralise control; and survey work, cable communications and other technical aids favoured this development. In the war of movement this control was lessened. The infantry regiments had their own batteries of accompaniment which proved of great value. Now and then larger bodies of artillery were incorporated in infantry regiments. I only know of occasions on which this procedure proved valuable and never heard of any drawbacks.

The general views held, as well as the regulations in most armies, now regard it necessary to place all the artillery of a divi-

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sion except the infantry batteries under the divisional artillery commander. Bodies of artillery are when necessary affiliated to infantry regiments or, in exceptional cases, placed under the orders of the infantry commander, a paragraph to this effect appearing in operation orders. The organisation of the greater part of the divisional artillery under a single control is, however, now as before the ideal of the ordinary gunner. The endeavour is made by utilising ranging power to the utmost to direct the grouped fire effect of a large number of batteries on to the most important targets, and the flat trajectories employed in this method give a greater depth to the fire. Part of the artillery can now fire at ranges formerly denied to us owing to difficulties of observation. And artillerymen are glad also of the further increase in range that is being obtained by the employment of heavier guns since the introduction of tracked under-carriages.

Judging from the experience that every new war presents fresh tasks to troops and knowing that much that has been stereotyped during recent years will certainly have to be abandoned, we must now ask whether the conceptions and customs outlined above will be correctly related to the tasks the artillery will have to perform in future war.

In the press and the military literature of the past year there has been considerable discussion as to how far the increasing use of motors for the transport of troops and the employment of armoured cars and tanks will influence tactics and strategy. It is thought that situations in battle will change more radically and more rapidly. Surprises—tank attacks from a flank and so on—will have to be reckoned with more than ever, and in these the infantry will need the immediate support of artillery. Batteries a long way off will not be able to render much support . . . .

The attention paid in all armies to camouflage will so hinder reconnaissance in the early stages of a battle that the C.R.A. will not have a picture of the situation sufficiently clear to act as a basis for the action of his guns. There is the danger that if he waits for better intelligence he may waste valuable time. Moreover, once the fight has begun targets will be small and there will be no definite lines to range on; but in their place small groups consisting of infantry and machine guns well distributed in depth and

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solitary O.P's, none of which will furnish suitable objectives for the controlled long range fire of batteries. It seems to me that in such cases, at any rate in the war of movement, the centralised direction of the greater part of the divisional artillery will not be possible. As portions of this artillery have hitherto been occasionally attached to or incorporated in the infantry regiments with good results, we might go a step further and make the latter arrangement permanent in war. I think that each group so placed under an infantry regimental commander should consist of at least two light gun batteries, one light howitzer battery, a half to one long-range gun battery and, when available, a half to one anti-tank battery. The artillery not allotted to regimental groups would form a reserve under the command of the C.R.A.

The commander of an artillery group, which would thus form part (in war only) of an infantry regiment, would have an interest for the combined work, quite different from that of an officer only attached for a single day. The habit of living together would reveal itself in a closer personal touch in action and would give each more insight into the work of the other. Another advantage would be that the commander of the artillery group need not await the instructions of higher authority, but might make proposals in accordance with the results of his reconnaissance to the regimental commander with whom he would be in constant touch and by whom he would not have first of all to be brought into the picture. It is particularly important not to postpone the consideration, ordering and execution of this allotment of artillery to infantry requirements till the beginning of a battle. With all the various natures of guns and ammunition such a procedure would entail great delay especially in the supply of ammunition. Those gunners who demand a special gun and special ammunition for each particular nature of target should take serious thought as to how ammunition supply could be effected in a division armed in accordance with their suggestions.

The artillery group would be billeted with its infantry, march with it and help it against surprise attacks by tanks. In battle it would remain close enough to it, to enable it to distinguish friend from foe and to destroy the small single targets whose destruction is beyond the power of infantry batteries. Only when not far in

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rear can it be in time to help against tanks. This proximity is essential because the infantry will but seldom have sufficient anti-tank weapons available or in suitable positions. When heavily armoured tanks appear, the artillery must certainly play its part. The objection must not be raised that it is difficult to hit such fast-moving targets with guns and howitzers of the ordinary type. It is not necessary for every shell to make a hit; for, according to experience, tank-crews are by no means insensitive to shells which burst in their neighbourhood.

If it be said that my plan involves the danger of splitting up the artillery, my reply is that it is right to do so. In a deliberate attack against an enemy in position, the reserve artillery, plus the artillery of regiments in reserve and some of that even of regiments in the forefront of the battle, may be brought under the control of the C.R.A. in order to effect superiority at the decisive point. Similarly in the defensive position and in static warfare special arrangements for the distribution and command of artillery will have to be made.

I foresee that this breaking up of artillery formations in war will be opposed on the artillery side. But in the world-war regiments of foot artillery were broken up beforehand. If we really want to further the liaison between infantry and artillery we must give up this practice of occasional touch and sanction the full acceptance of Barbara in the family circle of the infantry regiment.

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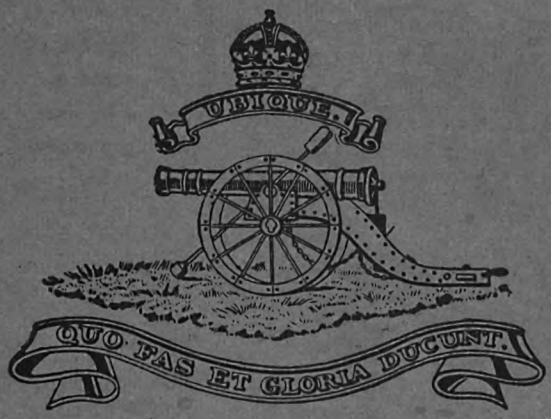

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LORD AMHERST. [See p. 478.

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TACTICS OF ARMOURED FIGHTING VEHICLES.

A Lecture delivered at the Royal Artillery Institution, on Tuesday, 23rd October, 1928.

BY COLONEL C. N. F. BROAD, D.S.O., *p.s.c.*

Lieut.-General Sir Webb Gillman, K.C.B., K.C.M.G., D.S.O., Master General of the Ordnance, in the Chair.

CHAIRMAN: Gentlemen, Colonel Broad, as most of you know, was for about 18 years a gunner. He was a very good gunner; and not only had he a shrewd knowledge of gunnery, but he also knew what a horse could do and could not do. He then went to the Tank Corps, possibly for reasons of quicker promotion than arose in the gunners or even in the infantry. I am sure you are looking forward to what he is going to say, because he can balance up the relative values of the Tank Corps and the gunners better than anybody I know. I now ask him to go on with his lecture.

COLONEL BROAD: Mr. Chairman and gentlemen, I am serving on the General Staff at the War Office, and I should like to say that the opinions I express to-night are entirely my own, and are not in any way General Staff opinions.

My lecture has to be divided into two parts: firstly, Organisation, and, secondly, Tactics. The only official organisation at present is the battalion of medium tanks, which, in my view, does not fully meet the case. Therefore before I can talk about tactics I have to talk about the organisation, which I think is required for armoured fighting vehicles.

I should like to start by a quotation from the old Chinese book of War which some of you may have read, written some two or three thousand years ago, in which the author says that "ground is the soldier's best ally." I submit to you that the solution of this tactical problem, as of all other tactical problems, lies in the correct use of ground. Now, use of ground I think may be defined as turning the accidents of the ground to your own advantage and,

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if possible, to the disadvantage of the enemy; that is to say that you want so to use the ground, as to exploit your most favourable characteristics with the particular troops that you are using. So that, the first thing that we have to do is to consider the characteristics of, firstly, infantry, and, secondly, armoured fighting vehicles.

Now during the war the infantry and the tanks were in many respects similar. They both moved at about the same pace. The ground was such that the infantry could not really use covered approaches. The tanks had the advantage of being armoured, but owing to their pace being similar to that of the infantry it was possible, and usual, for both to go hand in hand into battle. Since the war great strides have been made in the design and construction of armoured fighting vehicles of all kinds. The latest vehicles both medium and light can now do 25 miles an hour. Their circuits of action have been tremendously increased. The wartime tank could only do 25 miles without a change of sprocket wheels, and 100 to 150 miles was the limit of its tracks. A medium tank will now do 100 miles on one fill, and the life of tracks has gone up to beyond 1000 miles before you have trouble. These speeds are also combined with armour that is proof to ·303 A.P. projectiles.

Now all those characteristics put the infantry, on the one hand, and the tank on the other, into rather different categories. Add to that the fact that the infantryman can use covered approaches: that he can get down on to the ground and escape fire in that way; so I think we must deduce that the type of ground that the infantryman likes, and which exploits his best and most favourable characteristics, is one in which he can use those covered approaches in much the same way as the German infantry did in 1918. The armoured vehicle, on the other hand, likes to exploit its speed, and therefore it wants open country. Thus I think we can deduce that when you use infantry and armoured fighting vehicles, you exploit their most favourable characteristics by employing them in different sections of the battlefield although you may aim them at the same objective. From that of course it follows that the infantry, on the one hand, must be organised into a brigade of one kind and the armoured fighting vehicles, on the other hand, must be organised into a brigade of another kind. Supposing, at the present moment,

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we wanted to move a medium tank battalion round a corner to make a flank attack. As we are at present organised, the infantry are responsible for doing the reconnaissance for the medium tank, and they are also responsible for covering fire with machine guns. The horsed artillery in the division are responsible for doing some of the covering fire as well; but if these tanks are going to make a flank attack where they will meet the enemy's anti-tank gun fire, moving at speeds up to 20 miles per hour, the infantry will not be able to keep up; therefore there will be no reconnaissance for this move in front of the medium tanks, nor will there be any covering fire. Therefore there is obviously something wrong.

I submit that what is required is the armoured brigade, which I will talk to you about in a minute; but before going on to that, I do not want you to imagine that I suggest leaving the infantry where they are now with nothing but their horses or their feet to march upon. Petrol and armour are coming into life on every hand and they are going to help the infantry; they are not all going to be turned into armoured fighting vehicles because you require the man who fights on his feet, but petrol and armour will help him to get his machine gun and mortar where he wants them in battle and will also help him to march by mounting him in buses. The right idea is not to keep the tank, as we have now evolved it, back to the infantryman, but by means of petrol and armour to bring the infantryman up in line with the tank. Only in this way will real co-operation on the battlefield be again possible between infantry and tanks.

If, therefore, the armoured fighting vehicle is organised into a brigade, then all tactical functions must be expressed in terms of petrol and armour. We must therefore have machines suitable for reconnaissance, covering fire, assault, protection, etc. What machines will be required?

Let us look at the machines. I cannot show you up-to-date slides of all machines as some have not been photographed, but you can see enough to give you an idea of what it is all about. Now the first machine I want to talk about is the light tank. The slides you are going to see are the first beginnings of this light tank. The job of the light tank is first of all reconnaissance; that is the going forward, searching for information and possibly fighting

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for it. We may deduce from that that these light tanks must be numerous, and therefore they have to be cheap, but at the same time they must be efficient.

In that connection I would like to tell you a story about Napoleon's reconnaissance in his wars. His system of reconnaissance was the officer's patrol, and the French reconnaissance officer was extraordinarily successful. Napoleon was better supplied with information than any of the commanders at that time, and this continued until he went to Russia. When he got to Russia in 1812, the French reconnoitring detachments found themselves surrounded by the Cossacks who swarmed all over the country; the Cossacks rounded them up, and these French reconnoitring officers were caught, killed, or possibly tortured; but in any case they got "the wind up" and they lost their morale. Instead of finding out for themselves they stayed in the villages and asked the inhabitants what the country was like round about, and if they had seen the enemy, and then sent that in as their report. Now unless our reconnaissance machine is efficiently armoured and fit to co-operate with an armoured vehicle, reconnaissance will break down.

The machine shown in the first slide is obviously not efficient. Nor is that in the second; the people in both these machines are obviously very ill-protected. These machines of course were not designed for this particular job; they were merely the beginning. I cannot show you the machine that has been so designed, but it actually does exist. It is small and inconspicuous; it carries armour that is proof to ·303 A.P. ammunition. It is fast, that is to say it will do, say, 30 miles an hour on the road and it will carry a ·303 machine gun.

Thus we get to the second task of the light tank, i.e., covering fire. I would like to suggest to you in that connection that covering fire need not always be from behind; you can do your covering fire from in front just as well as from behind. What you want to do is to consider the enemy's point of view. If your attack is preceded by smaller machines, they will first of all reconnoitre for your bigger machines behind, and when they have forced the anti-tank gun to disclose itself, they will open fire on it. That is covering fire for the bigger machine behind which takes longer to get into action.

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This small machine also has light duties to perform, such as advanced guard, rearguard and so forth. In its work as advanced guard it will possibly meet machines of its own kind and therefore we must try to put on some of them, or on all if we can, a ·5 machine gun, so that it can destroy its own kind. In the war it was found that the tank which could not destroy its own kind suffered under great disadvantages. The only occasion when British tanks met German tanks was when some of our so-called female tanks met Germans in captured tanks armed with a 6 pr. gun. I forget what happened exactly; but the Germans either could not work their tanks or abandoned them so that no regrettable incident took place. However, if you meet a tank with a big gun and you have nothing, it is rather apt to be unpleasant.

In addition, we want radio-telephony in these machines. Radio-telephony has advanced to the stage when it is a practical proposition. We have, in the experimental armoured force down on Salisbury Plain, machines equipped with radio-telephony; so that people can talk to each other up to a distance of two miles in some machines and of five to seven miles in others. Wireless telegraphy, of course, will range much further.

The remaining point is the circuit of action. When you start out to make machines like this you have to decide on some circuit of action, and somewhere probably about 150 miles for a light machine and 100 miles for a heavy machine would meet the case at the present time. By circuit of action we mean that the machine should be able to do that distance without refitting; that is to say that it should carry the petrol and the oil and the grease for that distance, and all the other things we think it will want during that period—the ammunition, food for the men, and so forth.

Now we will take the medium tank. The role of the medium tank is the assault by fire. We all know what we mean by the ordinary assault when the infantryman goes up and sticks his bayonet into the fellow on the other side, but there were not many occasions in the last war where that actually happened.

The assault by fire, that is to say killing your man by fire, is the normal way in which people are killed nowadays. It is the only way they are killed at sea and it is the normal way they are killed on land. We know of examples in the late war where the

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Germans were forced to retire entirely by artillery fire. Before the actual attack on Passchendaele the whole of the German division opposite the XIV Corps evacuated their trenches and went back some distance. This was due entirely to the fire of the artillery.

Therefore what we are after in this armoured fighting vehicle business is this assault by fire. We kill our enemy by fire; but we must have in addition the threat of the cold steel weapon, and that we have in the track. It is just as unpleasant to be run over by a tank as to have a bayonet stuck into one, and all tanks are prepared to go in with their tracks if it is suitable.

But fire is the thing that wins in war, and fire is the thing they are built for. In other words, the medium tank is a gun platform and it has got to be built as a gun platform; you want the most accurate fire you can get from it. The little fellows in front having found the target and possibly neutralised it, you have to crush it with your accurate fire from behind, and these machines you see now on the screen will illustrate these points.

In laying down this type of machine you have to think about arcs of fire; power to concentrate your fire, fire control and also the steadiness of your platform. The first slide illustrates the medium tank Mark II which you will notice has only one Hotchkiss machine gun bearing forward. The Hotchkiss, of course, has a very small fire power, and therefore to get serious fire power from this machine you have to turn broadside on. I should like you to notice the size and shape of this machine before we go further.

The next slide looks a steadier proposition. It is a tank known as the independent tank. You will see the fire power is considerably increased by these Vickers machine guns in turrets on each side, and the commander can see and control his fire so that he can direct the guns on to their targets. The role of this type of tank is to put its maximum fire on to the target; the tank must therefore be manœuvred like a ship so that you get the maximum fire power on to the target and crush it right away. In this particular tank you can put three Vickers guns on to any target. The fire of three Vickers machine guns is very considerable from a steady platform. You will see from the length and shape, which are rather technical matters, that the platform of that tank looks extremely steady. It actually gives you the same sensation as going

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through the sea in a big ship; it is relatively solid and motionless.

In the next slide you see a slightly smaller but almost as steady a platform. This is a 16-ton machine. In this machine you have two Vickers machine gun turrets firing forward—and another Vickers machine gun in the main turret; so that you can get three guns firing forward with less weight: in addition you can deliver accurate fire, almost as accurate as shooting from the ground. From these two slides we are beginning to see what our tactics should be, tactics of course being dependent on the weapon.

Now the point comes up at once: what about the weight and cost of all these machines? I should like to say one word about that. It does not matter what these things cost or what they weigh within certain limitations; but what does matter is whether you are getting relative efficiency. If two tanks of one type cost a certain sum and one tank of another type costs less than the two together, and if the latter tank can destroy the two former tanks, then you are saving money even if you pay more for the individual machine. It is a question of relative efficiency the whole time. That is what we want to watch. You have to take your machine and say "AM I GETTING VALUE FOR MONEY?" and that is the whole problem all the time.

The other point I should like to mention is the question of the gun. The heavy machine gun or the 3 pr. forms the main armament of the medium tank. The small gun has the advantage, of course, that you get fragmentation from the shell, and you will therefore probably do more harm if you get a burst inside. It does not, of course, follow even when you get a burst inside, that you destroy the whole crew. I had an officer on my staff at Bovington who had been in three tanks which had been blown up by gunfire, and he is in the Corps at the present moment. It is probable that you will damage the machine if you have enough bits flying about inside; but on the other hand if you have only one bullet, even a big one, you may do no harm at all. That is what we found with the German anti-tank rifle; it was most unpleasant coming in, but it did not stop you in the same way as a shell burst inside did. Improvements in design may possibly bring us interior bulkheading, so that we can limit the effect inside, but we have not reached that yet. On the other hand the gun requires a heavier tank, and that

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pushes your weight up. You may reach a situation possibly where it would be uneconomical to build the size of tank which a gun requires. If you have to fight somebody who has not many tanks, or if you are fighting in savage warfare or anything of that kind, then of course the gun as opposed to the heavy machine gun ceases to be of primary importance.

Then there is the question of sea transport. The British Army has got to go to all parts of the world and has to land in different ports, and therefore we have to keep our machines to weights that can do that. The derricks of the average merchant ship are limited to 25 tons and we have to limit the weight to that amount.

The third machine is the mortar tank. The job of the mortar is to give covering fire where the light tank cannot give it.

It may be required to act against a defiladed or emplaced anti-tank gun or to provide smoke.

The mortar tank is an armoured fighting vehicle as it has to accompany the tank attack but its role is limited to that of covering fire. It is said that the looker on sees most of the game, and, thus, if you have a machine of this type following behind and looking out for trouble, it will save you many casualties that would otherwise occur.

The mortar will use both H.E. and smoke, but a word of caution about smoke. An incautious use of smoke will blot out everyone's vision: this will destroy formations and control; and make covering fire or mutual support impossible, and may well land you in confusion.

Do not imagine that smoke solves the whole problem.

The next machine is the command or signal tank. The commanding officer must move with his unit in a fast-moving show like this. You can have radio-telephony for him. He should give his orders by radio-telephony, i.e., voice control, as nothing else will be quick enough. He can do this if you provide the equipment, but you must also give him a machine that is not specially marked, and therefore exteriorly the machine must be the same as the rest of them. The radio-telephone equipment is comparatively small and you can increase the room inside by taking out the 3 pr. and carrying one machine gun only which he can use for self-defence.

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Another type of machine possibly required is shown in the next slide. Any of you who have been continuously bombed, especially in war, or even on manœuvres, have some idea of what may happen in the next war. The accuracy that bombers claim nowadays is very considerable. At a conference the other day I was told, and it was not disputed, that the 50 per cent. zone at 10,000 feet in the day time was 50 yards, and at 4,000 feet at night time it was again 50 yards. I do not know if that is true, but it sounds an astounding statement. Even if it is something like true, it is getting very nasty. If you combine that with big million-candle-power flares which drift down the wind, so that you cannot see the aeroplane, then any night movement in masses is becoming a very sticky proposition. The man in an armoured machine has the advantage that he is splinter-proof, but we do not know how concussion-proof he is. It appears therefore that we may want an anti-aircraft gun in these armoured brigades, and this slide shows the kind of machine which will be required.

The last two slides show transport vehicles. This brigade will be organised into two parts; the fighting part and the administrative part. The administrative part is rather similar to the old camp follower. The soldiers are the people who go out and fight in small numbers in these armoured fighting vehicles. They require people to help them to put things to rights on their return; when they come back at night they will require cooks, ordnance and R.A.M.C. personnel to assist them. These latter will travel in machines, either of the light six-wheeler or the medium six-wheeler type. You do not need to give them armoured machines because you can put them away somewhere safe when you go into battle. The vehicles are equipped with machine guns which can be manned by spare personnel. You may have to give them an escort of smaller machines, but you should try to put them into a more or less safe locality, and keep them there until the battle is over.

So much for the different types of machines and their tasks. These machines should, in my opinion, be organised into brigades composed as follows—

Headquarters and signal section.
One medium tank battalion.
Two light tank battalions.
One close support unit.

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Such a formation can be asked to undertake the following tasks in war :—

(i) To attack anything on suitable ground, that is to say, ground that favours its particular characteristics. This, generally speaking, is ground that that is unsuitable to infantry. Most of the Somme country, Salisbury Plain, etc., is favourable to that type of formation. The amount of covering fire depends on how long the enemy has been sitting down. In trench warfare it may be necessary to give a lot of covering fire. In open warfare its own covering fire should be sufficient.

(ii) You may start your battle with infantry because the ground is favourable to infantry, and at a certain point you may want to exploit the success of the infantry or the ground may have become more open; then you put your armoured brigade through the infantry and carry on with it.

(iii) In the pursuit of a disorganised enemy you can go over almost any ground because the hostile anti-tank arrangements will not be in good order, and you can take risks which you could not take in attacking infantry in a favourable position and well provided with anti-tank defence. Infantry on the defensive on suitable ground, properly equipped, can make themselves practically immune to tank attack.

(iv) Advanced guard, again, in suitable country is a task which should be undertaken by a formation of this kind. Also rear-guard work.

(v) Independent missions.

The independent mission is the exception, not the rule. Obviously an independent mission is usually dangerous and always expensive, but its results may be very great.

If you have read Stonewall Jackson you will remember the second battle of Manasses, where the Federal Army was along a river, 100,000 strong and the Confederates only 50,000. There was a big Federal depot at Manasses in rather thick country. You will remember Jackson with half the force moved from the Federal flank in secrecy to Manasses and set it alight. It was an absolute surprise; the Federals did not know that Jackson had moved. The first thing they knew was that their big main depot was going up behind them. The Confederate object was not to destroy the

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depot but to create an effect on the Federal commander's mind—a moral effect, and it was successful. The Federals started retiring; the rest of the Confederates started to join Jackson. The latter, having destroyed the dump, disappeared into the blue, again bewildering the Federals. To cut a long story short, when the second battle of Manasses was fought, the Federals had got into such a muddle that there were more Confederates that Federals, although the Federals started with 100,000 and the Confederates with 50,000: the Confederates won the battle and pushed the Federals right out of Virginia. This may be the sort of thing you may use these armoured brigades for, i.e., to create alarm and despondency and the ensuing confusion, providing the risks are worth it.

Incidentally, in suitable country, supply by air is becoming a practical proposition, which reduces the risks considerably, The machines are self-contained for their 100 miles circuit. There are not very many men, therefore food is not a very serious problem, and you are not going to shoot a lot of ammunition in this sort of fighting. Petrol, oil and grease are what you want. These freight carriers can lift five or six tons; thus the aerial supply of small forces, which may create effects far beyond their actual strength, is becoming a practical proposition.

(vi) Another role of the armoured brigade is to support the independent cavalry, that is to say, to provide the "punch" which the cavalry lack. Armoured cars, of course, are also required to carry out the long distance reconnaissance, something after the idea of the contact squadrons as we used to know it.

As regards the details of tactics: tactical principles will always remain the same; it is only in methods that we have to make changes.

All the time you should think whether you are getting the best out of your special characteristics, i.e., your petrol and armour and the fire power which goes with it. If you exploit these three you are probably on the right lines in your tactics.

If you have to put out an advance guard, you use your light tanks and your mortars. You want your light tanks for your reconnaissance and your mortar for a bit of "punch." It may be that the enemy is holding a bridge, and a little "H.E." will shift him.

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Many of you have experiences of what "H.E." does to people who are retiring. If you bring out a big enough shell, bigger than he expects, he will go back. I have known several cases. If you can bring up a fat mortar with light tanks probably you will get through, but in any case whether you use the gun or not, the great thing is not to sit down.

Remember that you are a mobile force, you have the power of movement and fire power in movement, and directly you meet a block you can swing round on both sides. If you have got into such thick country that you cannot do this, then you are using the wrong kind of soldier and the infantry will do it quicker than the armoured people, but if you are able to swing round at once from the rear then the enemy must go. If you cannot swing round it means that you are getting up against serious opposition, and you have to feel along the whole front and find out how strong it is.

These little machines go in first to draw the fire and find out what is there, secondly, to look at the ground, and thirdly, to report where the ground is favourable for the heavier machines behind. They then have to find the flanks in the same way, and in all this your fire and armoured power will help you and if you keep in movement you should have the other fellow guessing. You do not want to look into every hole and corner, because you have gone round the flank and the enemy cannot be prepared everywhere. Everywhere you go you are going at great speed, comparatively speaking, and speed is your protection. If you have to look at every haystack and every cottage you will never get anywhere; you have to be bold, and, as I say, any obstruction can be got round and attacked from the sides.

Now as regards the commander: he has got to be everywhere; he has to be on the spot to get the information. He will have come up in his fighting machine and probably he will want two kinds; one, the actual machine he can talk from himself, and one a longer range machine to send messages from.

Some way behind, perhaps four or five miles, will be the main mass of the brigade. This is composed of the other battalion of light tanks, the medium tanks and the mortars, all moving up. I would like to say a word about speed first. If you are always going to move in absolute military formation, you will always

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be slow. There are times when you are in close contact with the enemy, when you have got to be in absolute formation and to go slowly, but when you are moving up I think you have to act somewhat like one of the Confederate generals. I think it was General Morgan. He was a leader of irregular cavalry, who was extraordinarily mobile and moreover very successful in battle. He was a completely untaught soldier, and one of the other generals asked him how he got so many people about so quickly, saying: "Tell me, General, how it is that you are so successful? How do you do it?" General Morgan answered: "Any old how": saying his main idea was to get the "mostest" there the "fastest"! That is what we have to do.

As regards the organisation of the main body of the brigade we have in the medium tank battalion three companies, and our tactics, I hold, are built round these three companies.

These companies are the units that are going to give the blow, and we have to arrange our local reconnaissance and covering fire round each company. Therefore, each company will have its light tanks and its mortars, and the brigade moves up organised into three small but complete fighting formations: possibly one behind the other or on a broader front according to the ground and circumstances. You must have small complete formations in a quick business like this, and the three components must be trained to work automatically together. Thus when a medium company attacks, the covering fire and reconnaissance work automatically with it, something on the lines of horse artillery and cavalry. There is no time for detailed orders; it has got to function automatically according to your previous training.

Now by this time the commander will have selected his objective which he is to attack. He has got to get this information back to the brigade which he has already directed to some rendezvous, and the only way he can do that, if voice control is not possible, would be by sending officers back. If you look into history you will see the same difficulty occurring. Napoleon used to send his A.D.C's to lead people in the right direction. It used to be the only way to direct mobile troops, and we shall probably have to do the same.

The commander will then place himself in the middle of his

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brigade probably at the head of the last of the three groups. The place for every commander is at the head of his reserve.

The two leading fighting groups then advance to attack; they use their mobility to get where the people in front say the softest spot is. They swing round comparatively rapidly to that place, and they then go straight in. You cannot wait about; the little machines in front find out the trouble, the accurate fire power from behind squashes it, and you go straight through. The commander at the head of his reserve can use that reserve to help you through, but the whole thing goes through as one formation until you get past the worst of the battle. Then the rally, of course, has always been a difficulty. That is what you have to train for; you have to train so that your people automatically rally as quickly as possible, and the man who can rally first wins.

Now it is probably at this time that you find the greatest danger from the air. You will have to wait about to a certain extent to rally, and it is then that you will probably require an anti-aircraft gun to protect the rally. Having rallied, you attack again. That is the kind of operation, as I foresee it, for armoured fighting vehicles.

Defence, of course, they cannot do. They can only attack. If you have to defend a place you will require infantry to defend it. For the defensive-offensive style of battle, the armoured brigades can be used for the counter-attack while the infantry hold a position or pivot of manœuvre.

Armoured brigades may find themselves separated from the rest of the army and be obliged to find their own protection. During the day they would patrol and observe in the normal manner. At night they go into a laager.

The fighting machines are round the outside and you have rather elaborate arrangements for your arcs of fire, so that all the ground around is swept by machine-gun fire. The transport is in the middle and one section of tanks is told off as an inlying picquet, with engines warm, so that it can go out at once on any alarm and charge anything outside. Shock action at night is perfectly practicable and is commonly done now.

You will also certainly have foot patrols about outside: you have a fair number of men, and people in armoured fighting vehicles

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have got to get out, when necessary, for reconnoitring on the road, and certainly to do some foot work at night; and if you are laagering in woods you will have patrols outside to see you are not being stalked and so forth.

The other obvious arrangement you must make is to move if your laager is spotted from the air by night bombers, and you may have to move quickly. It is all a question of drill, and the obvious precaution of having selected an alternative position, so that you can move quickly to the new place. All this boils down to drill, which has been forgotten for the last few decades. You must teach an individual man to act on his own initiative, but when you come to deal with machines you have to go back to drill.

Finally, a word about night operations. Marching at night with machines is perfectly easy and practicable. Finding your way with a map is difficult, but it can be done. Keeping in touch is one of the difficulties. On a dark night, with your lights out, unless you are well trained, you will get a break in the column and people will go astray. Bombing machines may force you to move in small columns and in scattered parties, and that needs very good leading on the part of your subordinate commanders. The section commanders, i.e., the young officers have got to be prepared to act on their own initiative; you will collect your small columns by means of radio-telephony when there is a job to be done.

Night operations have taken place a good deal lately. Shock action, of course, is what you employ at night. Your small machines can locate the target if it is big enough, but the location of a target at night is an extremely difficult thing. We tried to devise some form of long distance flare to go about 300 or 400 yards, so that it does not illuminate the machine but it does illuminate the people you are looking for; but it is not very successful at present. By the time the flare has burnt out, the machine gets there and sees its target and goes bald-headed for it. You can be very bold at night. It is very perplexing when you are amongst a lot of machines moving about in small parties. You have no idea where they really are.

One night I was standing at the bottom of a little hill where there was a wood. There were three tanks standing on the skyline, as plain as could be. The engines were all running and the exhausts

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spitting out flame. A patrol under an officer came out of the wood, and there was such a noise of machines in all directions that they were quite addled as to where the machines really were, and they looked out of the wood and said: "Where are the tanks?" Somebody pointed them out. "No," said a sergeant, "they ain't tanks, they're trees." They thought they were trees! Eventually an officer saw the flame and pointed it out, but all these patrols were quite muddled as to what was going on. The moral effect at night is very great, and therefore the right thing at night is to go in with your track, for shock action as sight—that is frightening to anyone who has experienced it, even on manœuvres.

Speaking generally, of course, these tactics have still all to be worked out; it is all in an extremely rudimentary state, and the main thing you want is a very open mind if you are going to study this problem, because you have constant changes. We who are thinking about it are always scrapping our methods as new machines bring in new tactical conceptions, and you have to scrap the old to exploit the characteristics of the new. The only safeguard is to turn to history. There is nothing new under the sun. It all repeats itself. You will find in the history of the old arms, the infantry, cavalry and artillery and even the navy, things to guide you the whole time, and it is by the judicious blending of these tactics that we shall eventually evolve the right tactics for using these machines in the next war. (Applause.)

CHAIRMAN: Has anybody anything to say or any questions to ask?

MAJOR-GENERAL PECK: Sir Webb Gillman and gentlemen, you asked me if I would open a discussion on this very interesting lecture to which we have just listened. I should like, I think, first of all to say that Colonel Broad is to be congratulated on the exceedingly concise, able and lucid manner in which he has brought so big a subject before us in a comparatively short space of time. About three weeks ago I opened the newspaper from which I hoped to get my morning inspiration, and I saw at the top of it a startling statement, something of this type: "Surprising lessons of the Army Manœuvres. Tanks no longer a menace." I am relieved to find

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that that is not the opinion of the General Staff as put forward to us by Colonel Broad, or my job would be finished. I also saw a few days ago a weekly journal which masquerades under the title of "Truth," in which they accused a perfectly harmless and efficient brigade of artillery of harbouring a monster which they called the Bulford negress. It may interest you to know that the War Office does not subsidise black labour, nor has it any intention of issuing to units negresses for traction or for any other purpose. So do not be alarmed by what you see in the newspapers. They sometimes get hold of the truth with regard to these mechanisation problems, but very often they do not. However, they are interesting reading and a good deal can be learned from them.

Now, time is very short, and I am sure you do not want me to say very much, so I propose to fasten my teeth into simply one point which Colonel Broad has made. That is the point which he made last, and I have no doubt whatever that he made that point last because he thought it was the most important and he hoped that you would retain it when you left the room. The point he made was the necessity of keeping a free and open mind on this subject of mechanisation. Nothing could be more likely to mar the progress of this mechanisation than to consider that everything is known about it. My office is sometimes crowded with people who come in to tell me that they practically know everything about it; they know that for this purpose you must have a six-wheeler and for that purpose you must have a half-tracked machine, and for some other purpose a fully-tracked machine. I, Sir, have been instructed during the last month even to provide a four-wheeler for cross-country purposes. Mechanisation is in its infancy, and anyone who thinks that he has mastered the subject already and does not realise the possibilities of it in the future, is to my mind exceedingly devoid of imagination. As Colonel Broad pointed out to you, tactics must depend to a very large extent on, or at any rate must change constantly with, the changes in design of the vehicles. Vehicles depend for their design, at least a good many of them, upon commercial requirements. It is essential that we should use as far as we can machines which are produced for commercial purposes, and we all know that commercial requirements are changing every day, and therefore it is quite clear that the tactical handling of an armoured force must

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also change to a certain extent. It may interest you to know that some of the light tanks which have been manœuvring with the armoured forces during the last year have travelled as much as between 700 and 800 miles. It is a fact that a tank battalion commander nowadays would consider that he had not done his job if he could not produce at least 15 out of 16 tanks whenever he is called upon to do so Three years ago not even the most ardent and enthusiastic designer would have thought such a thing possible. It has only been made possible by the increased efficiency of the training of the crews of these tanks and by the constant changes also in the design of them. Therefore the point I wish to make from this is that owing to these changes the tactical handling of an armoured force must be constantly changing.

There is one other point, Sir, I would like to make, and that is that up to this time the armoured force has functioned over an area which is peculiarly flattering to the cross-country capacity of the vehicles which go to make it up. Salisbury Plain is the ideal place for ease of manœuvring. Added to that, the armoured force, this year at any rate, has laboured under the very grave disadvantage for such a force of having exceedingly fine and wonderful weather; in other words, they have not had to face any great difficulties. Now as I understand the situation, before any real decision is made as to future tactics of armoured fighting vehicles I hope that some area will be found—it need not be as large as Salisbury Plain—in which a small armoured fighting unit can be put, such as Dartmoor, or parts of the Aldershot area, or in Egypt or India. Until we get the experience of handling armoured fighting vehicles in those kind of areas, I cannot see that there is any chance of coming to any definite decisions as to the proper tactical handling of such a force.

If I may say one other thing, Sir, it is that, in my view, the successful tactical handling of an armoured force entails on the part of the staff officers who write the orders, a detailed knowledge of the capacity of the machines with which they have to deal. I mean that they must know much more about the speeds. They may know the maximum speed that a vehicle will go, but that is not sufficient; they must also know the most economical speed at which such a vehicle will go. They must know its most economical speed

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both across country and along the roads; they must know the cross-country capacity of each type of machine, that some machines can go better than others along the roads, and others better across scrubby country, or rocks; They must know the weights they can carry, and they must not overload them. A machine which is overloaded may go on, but it most certainly will stop sooner or later. They must know the radius of action of each type and realise that it will depend on the type of country which it has to go across. If you have to use low gear for a big proportion of the distance, you will not get as great a distance out of your petrol as on roads. So that I feel that great danger is likely to occur, or at any rate more danger is likely to occur, from bad orders of staff officers than by bad handling of the individual commander. (Applause.)

MAJOR-GENERAL DE PREE: May I ask Colonel Broad whether he proposes to use tanks with infantry at all. We have chiefly used them in close co-operation with the infantry in the past. Does he propose to keep that up?

COLONEL BROAD: I think the answer to that is this. The infantry go on as far as they can, i.e., they can advance under favourable conditions but will be stopped by open ground. Tanks and infantry to my mind, cannot help each other if they go hand in hand as in the last war, as their tactical characteristics are so different. Infantry move very slowly and they are very vulnerable to machine-gun fire, and they will therefore choose the piece of ground that protects them from machine-gun fire and where they can infiltrate. The tanks, on the other hand, want to go fast to avoid anti-tank gun fire, and therefore if you put them into that sort of country they will not help the infantry and will become victims of the anti-tank guns. On the other hand, if you put them in round a corner on ground of their own choosing, they will be helping the infantry more because they will be exploiting their favourable characteristics. That is rather theoretical. You may not always be in a position to do it but it shows the ideal; I hold that the infantry should be used on ground where they can exploit their most favourable characteristics, and the armoured troops the

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same but nevertheless directed at the same target. That is the way in which the armoured brigades will best help the infantry brigades and best help the Army. If you tie the tank to the infantryman, it has got to go very slowly and offers a good target all the time. It is interesting to note that exactly the same controversy took place between 1750 and 1790. You will remember that in Marlborough's wars the heavy cavalry formed up in line with the infantry, they advanced with the infantry and they then fired their pistols; I think they actually walked into battle, drew their swords and started chopping at the enemy. Then Frederick came along and started to make them gallop, as Alexander made them gallop. If you read Alexander you will find that everything I have been saying was done in principle by Alexander. It is all as old as the hills, and it is there written in black and white. Frederick made his cavalry gallop; and the controversy went on for about 50 years. There is a book called "Cavalry" by a Prussian, General Warnery, you can get it in the R.U.S.I. library, and there is a chapter in it saying that people who wanted to make cavalry advance in line with the infantry were completely out of date because the cavalry could not help the infantry in that way. The argument was that now that the armour had been reduced by the advent of the rifle, they could be taught to gallop, and therefore if you let them go round the corner and gallop in at the same target, they could help the infantry much more than if you made them advance with the infantry where they would be vulnerable to every discharge that was made, and not only would the cavalry be killed, but no one would get there in the end. I think it is the same problem and we have arrived at the same stage, where the tank will help the infantry much more if you organise it in formations, with all its tactical functions expressed in terms of petrol and armour: rather than if you send units hand in hand with the infantry as in the late war.

MAJOR-GENERAL DE PREE: It seems to me there are two snags in that. First of all, the effect of the tank is so fleeting and you will have to have such extraordinarily good arrangements to get the two more or less together on to the position you are assaulting, that in ninety-nine cases out of a hundred you will fail if you go a very long way round with your tanks. The second thing, it seems

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to me, is that you cannot absolutely lay down one piece of ground as infantry country and another as tank country. What usually matters to the infantryman is the last 100 yards. He may have a very favourable country to get up to the objective, but then he has to get over the last 100 yards, and that is where the tank, if it is working closely with him, can help him. Talking of history, there have been instances in the last war where tanks did work in close country with the infantry with success. I personally saw it at the forest of Mormal in November, 1918. It was very enclosed hedge country and you could not get on until the tanks absolutely saw you into the enemy's positions. If the tanks had made a very wide sweep round, they might quite well have careered over the enemy by themselves. He would have lain low and come out again when our infantry came up if the two were not working together. This frequently happened at the first battle of Cambrai. It seems to me that what you propose may be the right tactics theoretically, but if you are going to get value out of the tanks in practice you must have a certain number of them working closely with the infantry.

COLONEL BROAD: The tanks in the last war, of course, could not go round because they had not the necessary circuit of action. They could not run long enough to go round, and the anti-tank gun business has so advanced since the last war that I think if you put your tanks in slowly in thick country you will have enormous casualties.

MAJOR-GENERAL DE PREE: Then we get back to the deadlock we had before.

COLONEL BROAD: You get back to the deadlock you had before, and you lose all your tanks and you have to stabilise. If you try to use your tanks where they will be effective you may succeed in keeping them mobile, but if you get them all knocked out you are no forwarder.

MAJOR-GENERAL DE PREE: In the last war we covered them with barrages and smoke and attacked at dawn. That prevented them getting knocked out. We shall have to do it again.

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COLONEL BROAD: That again presupposes stabilisation. Our hope in this business is to get more mobility.

There is just one point mentioned by General Peck. He referred to the "Daily Express," and he coupled that with the name of the General Staff. I can only repeat my first disclaimer that my opinions had nothing to do with the General Staff: I do not know whether the General Staff initiated the notice in the "Daily Express" or not! He also mentioned the armoured force. I have not been talking about the experimental armoured force; I am talking about my own ideas. General Peck mentioned that the conditions were so very favourable. Of course they were, on the score of ground, climate, and so on; but there is a lot of talk about this experimental armoured force at the present time, and in order to be fair to that force I think you should know the enormous difficulties in other respects under which they have been labouring. They started two years ago, and all the time they have had no reconnaissance machines. That is very largely due to the financial system under which we work. They were started with a dollop of money in November, 1926, and some machines were bought. Obviously no further money could be voted in April, 1927, as the first machines were still under construction. The money voted in the following April did not become effective for pretty well a year, and it is only now that the reconnaissance machines of the inefficient type of which you have seen pictures are beginning to appear. Before these machines appeared, i.e., all the time to date they have not even had pieces on the board; they had only 16 little machines to work for the whole of the force, and the rest of the covering fire was represented by an infantry battalion in lorries. They had no radio-telephony until this year, and then they only got the full outfit about a week before manœuvres. Under these conditions it is extraordinarily difficult to run a force of this kind; they cannot really produce tactics, and therefore it is not right to judge by what you see them do at manœuvres; it is no indication of what they can do, and they have, as a force, been struggling under immense difficulties.

CHAIRMAN: Time is getting on and we will not ask for any more comments; if we did I do not think we could come to any

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decision. I told you that Colonel Broad was a very good gunner, and I think you will agree with me that he is as good and as optimistic a Tank Corps officer. I am glad that he mentioned at the end that there was a thing called an anti-tank gun, because I am responsible for making them, and I hope they will be of some use to us, not to our enemy, as time goes on. General Peck sounded a useful and I do not think pessimistic note of warning, and the whole trend of to-night's discourse I think makes us all realise that we are just feeling our way at present. We have a lot of new vehicles in being and coming into being; they are vehicles of different potentialities and weights and different speeds, and as they become more numerous on the battlefield or manœuvre field we have to evolve new methods—that is to say, the General Staff; I am only the merchant who provides them—to produce the best tactical results and perhaps to come to some solution of the controversy which General De Pree mentioned of helping the infantry to gain any position we want to capture. There are one or two little points in Colonel Broad's lecture I would like to mention. He started with what the Chinese said, I think, 2000 years before Christ, that "ground was the soldier's best ally." That is as true to-day as it ever was, and I think it affects the Royal Tank Corps more than anybody in the Army, because they are trained to be most efficient mechanically, but when they get under fire they have only one little hole to look through to see how they can make the best tactical use of ground, and ground is unquestionably their best ally if they wish to avoid getting their tanks knocked out. They therefore require careful training in the best utilisation of ground to enable them to be of the greatest assistance to the rest of the Army. The other point General Peck has already commented upon; that is to say, we must have an open mind. We have a lot to learn, and in the next three or four years I hope there will be more machines on the ground and that we will be beginning to learn something.

I am sure you will all agree with me that we want to thank Colonel Broad very much for his interesting lecture and the great food for thought which he has given us. (Applause.)

COLONEL BROAD: Thank you very much.

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DOES RADIO TELEPHONY OFFER A POSSIBLE SOLUTION TO THE MAIN ARTILLERY PROBLEM OF THE DAY?

By Lieut.-Col. A. F. Brooke, D.S.O., *p.s.c.*, R.A.

Part I.

1. *Introduction.*

IN THE following article it is only proposed to examine the tactical aspect of the problem with the object of endeavouring to draw some deductions as to what artillery wants and hopes to get from wireless methods of intercommunication. In a subsequent article the technical side of the problem will be approached in an attempt to arrive at some conclusions as to how far these requirements can be met, what the main difficulties are that remain to be overcome, and the extent to which our tactical conceptions may have to be altered so as to adjust themselves to the main technical difficulties.

2. *The problem.*

The fundamental task of artillery consists in placing projectiles at a required spot at a given moment. Modern developments in war have increased the distance between the point of departure of the shell and its ultimate destination to such an extent that it is now seldom if ever possible either to know or see this required destination from the close vicinity of the gun. Improvements in small arm weapons have driven suitable artillery positions beyond the effective range of such weapons, whilst increased accuracy of artillery fire and the advent of the aeroplane have compelled artillery to take cover from the ground as well as from the air. As a result we find ourselves faced with the problem of bridging over the gap that now exists between the individual requiring the assistance of the shell, and the individual responsible for directing it to its required place. The time when this distance could be

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bridged by the human voice has long been left behind, and attempts to substitute visual signals met with only limited success. Telephone communication went a step further towards solving the problem, but fell far short owing to the unreliable necessary link in the shape of vulnerable insulated wires, slow to establish and liable to constant interruptions. Throughout the Great War the problem remained unsolved in spite of its ever increasing importance, and constant efforts towards its solution. Since it remained impossible to communicate with sufficient rapidity and reliability between attacking troops and their supporting artillery, it became necessary, instead of directing shell when and where required, to predict previously both as to time and place. Pre-arranged artillery programmes replaced observed artillery support, with all the disadvantages such a procedure entailed; attacking troops were shorn of a large proportion of their tactical mobility, whilst a vast wastage of ammunition became necessary. Even such methods could not ensure adequate artillery support, provision had to be made to meet the contingency of errors in previous predictions, and for support beyond the limits of the pre-arranged programme. Since no efficient system of intercommunication existed with which to bridge the space between the destination of the shell and its point of departure, the only remedy available was to endeavour to reduce this distance by pushing a proportion of guns further forward under the classification of close support artillery.

In the evolution of the tactical handling of artillery such a procedure can only be regarded as a retrograde step, adopted as a temporary expedient, since modern developments in small arm weapons, and the introduction of automatic weapons, had already shown that the artillery can no longer manœuvre within the zone swept by efficient small arm fire. The true solution of the problem, therefore, cannot be found in an endeavour to shorten this intervening space, but must be sought through improved methods of intercommunication with which to bridge the existing gap.

With the advent of mechanisation in the army the problem remains as important as ever, and in some respects harder to solve. The struggle between mechanical fighting vehicles and automatic weapons intended for their destruction has already started. The mobility of the mechanical infantryman of the future is certain to

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depend on artillery fire power with which to overcome automatic weapons opposed to him. Artillery weapons, even armoured, will be unable to operate efficiently within a zone swept by accurate automatic anti-tank weapons. We shall therefore still find ourselves faced with the self-same problem of bridging the space intervening between artillery suitably sited for the task and the point at which its fire power is required.

3. *The ideal.*

Before passing on to examine whether radio-telephony offers a possible solution to our problem, it may be wise to endeavour to arrive at the requirements of an ideal solution. Evidently such a solution cannot remain solely dependent on methods of intercommunication. Other important factors such as the ideal standard of individual intelligence and training, have a vital bearing on the question. The time is not in sight when we can hope for conditions admitting of a homogeneous force composed of super-men, when each individual would at any moment be capable of accurately appreciating the situation confronting him, and of efficiently applying the exact degree of fire power necessary with due regard to its economy and co-ordination. If such conditions were reasonably possible, the ideal solution would entail universal and continual communication between all members of the force in order to develop its full fighting efficiency.

Since the realisation of such an ideal of intelligence and training is still too distant to be worthy of serious consideration, we may return to the realms of possibility, and base our immediate aim on the necessity of exercising continuous economic and co-ordinating influences on the control of artillery fire power in battle. Taking the above factors into consideration the ideal solution of our problem may be expressed in the following terms:—

> "Immediate, reliable and continuous methods of intercommunication between fighting troops and their supporting artillery, through the medium of a special organisation, admitting of the co-ordinated and economic application of artillery fire power where and when required."

Our aim, thus stated is no doubt shorn of some of its idealistic qualities, but still offers a satisfactory solution to our problem.

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4. *The present.*

It will be advisable next to examine the present situation with the object of judging how far we still have to travel in order to reach the modified solution we have set ourselves.

The situation has now been reached where a few experimental radio-telephony sets have been issued to certain artillery brigades for a trial during the recent training season. These sets necessarily only represent one of the initial stages in the evolution of radio-telephony as a means of artillery inter-communication, as such they necessarily fall short of our ideal requirements. Yet the results obtained from them augur favourably for the future. The circumstances under which they were tried out were not such as to render it possible to develop their maximum efficiency. Personnel intended to operate the sets could only receive a very short and hurried course of instruction in the use of the instruments; in spite of this distinct disadvantage intercommunication was almost always established when no mechanical defect existed in the sets, a fact which speaks very highly for the degree of simplicity reached in the operation of the sets. There can be no doubt that with operators trained to the same standard as normal battery telephonists many minor troubles and defects could have been overcome by them.

Another serious disadvantage under which the sets were tried out in horse drawn batteries was due to the improvised method of transport provided for them which was seriously deficient of adequate springing to counteract the present delicate nature of the sets. As a result casualties to transmitting valves accounted for the majority of failures in intercommunication.

In spite of the above difficulties efficient intercommunication was repeatedly maintained during the recent manœuvres under circumstances which would have rendered telephone communications too slow to establish to meet the needs of the tactical situation prevailing at the time. Admitting that the results obtained so far are yet a long way from fulfilling all requirements, yet they certainly remain sufficiently promising to constitute a very definite step towards the long sought for solution.

Distinct disadvantages such as the weight of sets and their delicate nature must still be overcome. Many technical problems connected with the ever-increasing wireless activity in the field of

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battle, and hostile interference and interruption must still be solved. Yet, when we take into account the surprising rapidity with which wireless methods of intercommunication have developed during recent years, without being unduly optimistic, it certainly seems likely that a satisfactory solution lies within our reach provided we are prepared somewhat to readjust our present conceptions concerning handling of artillery in the field.

5. *Future developments.*

Recent trials proved that four pairs of sets operating within an artillery brigade could be worked satisfactorily and without undue mutual interference. As these sets were the only ones employed at the time it remained impossible to test the degree of interference likely to arise between neighbouring artillery brigades. Furthermore, since trials were carried out under the mobile warfare conditions of manœuvres, with formations operating on wide fronts, congestion was less likely to occur. Hostile interference and interception was also completely absent thus adding a further simplification. It is therefore impossible to draw any final deductions from recent trials as to the effects of the probable future congestion.

The number of sets which can be safely operated within a given area must, however, remain a matter for experts to settle, and as such does not enter within the scope of this article. A distinct duty nevertheless rests with artillerymen to arrive at some conclusion as to the general system of radio-telephony communications necessary under varying tactical conditions, so that experts may be provided with some specification to work to.

Two factors exercise an important influence on the question, firstly the frontage of attacking formations will usually decrease as operations become more deliberate, whilst at the same time the artillery fire power required to support these attacks increases. Consequently a distribution of sets based on conditions of mobile warfare will probably lead to congestion and serious mutual interference in more deliberate operations unless provisions are made to meet this contingency.

Secondly the more deliberate the operations are, the more possible does it become to meet some of the requirements of

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artillery intercommunication through the medium of telephone and visual signalling, especially on the rearward links of control and command.

We may now examine the question of the distribution of sets and wave lengths for mobile operations, and subsequently pass on to more deliberate operations with the object of arriving at the modifications necessary.

Within the battery a minimum of two sets is essential, namely one for the battery position and one for the O.P.. This minimum is however insufficient, and it is desirable that a battery should be provided with two extra sets, for work at detached O.P's, flank observation, detached sections, and replacement of casualties. As all these sets could be satisfactorily worked on the one wave length, the additional sets would not seriously affect the question of congestion.

Turning to the artillery brigade headquarters, one set is essential for communication to any of the batteries within the brigade, no special allotment of wave length appears necessary since communication can be established on the wave length of the battery with which communication is required. Four receiving sets will, however, be necessary to admit of brigade headquarters listening on the four battery wave lengths, thus rendering it possible for batteries to call up brigade headquarters when required, and also providing a valuable means by which the brigade commander can continuously keep in touch with the action of his batteries. In addition one extra set will be required to listen in on a divisional artillery wave length should the zone call system described later prove necessary. A total of two ordinary sending and receiving sets, and four receiving sets consequently seems necessary for an artillery brigade headquarters.

The provision of radio-telephonic communications between divisional artillery headquarters seems for the present to be a debatable point. In view of the greater distances that may be entailed it is possible that a separate type of set may be required. It would appear advisable for the present to concentrate our efforts on the more forward communications. Should eventually such communications be found necessary an allotment of one sending set working on the divisional artillery wave length, and a number

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of receiving sets equal to the number of artillery brigades within the division would be sufficient. Such an allotment would no doubt assist in the general co-ordination of the action of the artillery within a division.

The above suggested distribution therefore only entails an allotment of four wave lengths per artillery brigade, and possibly one additional wave length common to the whole of a divisional artillery. Assuming a division supported by its own divisional artillery, and one medium battery an allotment of 13 or 14 wave lengths would be required. In an ordinary advance on a front of two infantry brigades each supported by one artillery brigade, and with the remainder in reserve, some 8 to 9 wave lengths would be in operation on a front of at least 10,000 yards. Judging from experiences gained during the recent manœuvres it does not seem probable that serious mutual interference would be experienced under these circumstances.

Turning to the next probable stage, we may find the above division with a frontage reduced to some 6000 yards, operating against some minor form of resistance. Under these circumstances it is probable that the whole of the available artillery may be deployed to assist in the advance. We shall then find ourselves with some 13 to 14 wave lengths to operate within an area of approximately 6000 by 3000 yards. If we assume batteries evenly distributed along the front, this only allows for a space of some 400 yards between each set of wave lengths. Since both batteries and O.P's will usually be grouped to make full use of topographical features this intervening distance will usually be greatly reduced. It is for technical experts to decide whether such a procedure is possible, but it seems probable that for the present we are still some way from fulfilling the above requirements without incurring grave danger from mutual interference. Should this be the case expedients might be made use of which we shall examine when considering the congestion likely to occur in more deliberate operations.

It will be noticed that in the artillery which we have been considering as allotted to a division the light artillery has been omitted on the assumption that through the medium of radio-telephonic communications the services of this artillery will in the future be dispensed with.

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Turning now to an operation of a more deliberate nature, we may assume a division supported by its own divisional artillery, two army brigades R.A. and one medium brigade R.A. The frontage in this case might well be reduced to 3000 yards, the depth of distribution of artillery will remain about 3000 yards, but the total number of wave lengths to operate within this area has now increased to approximately 25. Namely about 100 yards between sets, assuming an even distribution along the front. Experts may possibly in the future overcome the difficulties incumbent on such a congestion, but for the present it is for us to examine whether such a congestion is necessary from a tactical point of view, or at any rate what readjustments might be possible to fall in with the general requirements of methods of wireless intercommunication.

The introduction of radio-telephony renders it advisable to reconsider our present methods of artillery control, we must broaden our outlook, and not confine ourselves to considering this new method of intercommunication merely as a substitute for older ones. The facilities which it affords for broadcasting information, and for lateral intercommunication between observation areas along the front, or between O.P's and batteries other than their own, should render it possible to centralise somewhat the control of observation. Such a procedure would reduce the number of O.P's employed and at the same time provide each battery with increased observation of the front.

In the case of a deliberate attack such as we have considered above, each field artillery brigade would be directly responsible for a frontage of only some 600 yards, in many cases such a front could be observed by one or two O.P's It should therefore be possible, under these circumstances, to reduce the number of wave lengths to one per artillery brigade. This would probably necessitate appointing one station as controlling station, either that at artillery brigade headquarters or at the central brigade O.P. As a result the 25 wave lengths which we found necessary would be reduced to seven.

In order to render such a procedure feasible the provision of a special organisation within the artillery brigade appears necessary. A special brigade observation detachment is required, the object of this detachment being to form the necessary link through which

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information is collected as to the requirements of attacking troops, and translated into the required supporting fire. For want of a better name we shall throughout this article refer to this organisation as a "close support intercommunication detachment." The composition of this detachment must necessarily remain elastic and vary according to the situation. It would be detailed under artillery brigade arrangements and would normally comprise one major or captain in charge of the detachment, two or more subalterns, two or more R/T sets with operators, and a proportion of visual signallers and telephonists.

The close support intercommunication detachment would establish one central O.P., in the locality obtaining the best observation of the whole front of the attack to be supported. Subsidiary O.P's would be established if necessary, either in telephonic communication with the central O.P., or equipped with R/T set capable of communicating with any battery in the brigade. Similarly small liaison detachments would be maintained either at battalion, company, or even platoon headquarters according to the requirements of the situation, the communication to these detachments might be maintained by telephone or visual to the central O.P., but more probably by R/T sets intended to push forward with the attack. Through this organisation the observation and control of fire within the artillery brigade would be centralised in the hands of the officer in command of the close support intercommunication detachment, who would also be in an excellent position to coordinate the registration of the brigade zone either by fire or by observation. He would remain in continuous R/T communication with the artillery brigade commander, keeping him informed as to the tactical situation, ready at any moment to register any of the four batteries by R/T communications, either personally from the central O.P. or through the medium of one of the subaltern officers from the best subsidiary O.P. If necessary he could control any concentrations, required by the brigade commander, by broadcasting information, orders, or observations of fire.

It may be argued that the artillery brigade commander should under these circumstances take charge personally of the close support intercommunication detachment, but it would certainly appear more advisable for him to remain in his present position at infantry

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brigade headquarters, from which position he will still be best able to direct the fire of his brigade in conformity with the general plan of attack. Incidentally, radio telephony will facilitate the combination of artillery and infantry brigade headquarters, since the difficulties of establishing telephone communications to batteries from the forward positions, usually selected for infantry brigade headquarters, will no longer exist.

During the actual advance a system of leap-frogging R/T sets will become necessary, and will be established by the close support intercommunication detachment. Small parties under subaltern officers will be pushed well forward ready to open up as soon as circumstances permit, the central O.P. being ultimately moved forward to one of these points.

Any forward move of artillery brigade headquarters in conjunction with infantry brigade headquarters will also be greatly simplified, one R/T set being sent on ahead to advanced infantry brigade headquarters, ready to open up when required.

The above organisation does not contemplate dispensing entirely with telephonic communication until such time as radio-telephony renders such a procedure practicable. For the present communication would be duplicated by telephone when time and circumstances rendered it possible.

The liability of interception of messages renders it necessary to consider whether any form of code or cypher may become necessary. In the majority of cases the nature of the message will be such as to convey no useful information to the enemy, but there is no doubt that a proportion of messages will not fall in this category, and will require special provisions.

The range of artillery R/T sets is a matter of some importance, and a question which cannot be left to technical experts to decide. Broadly speaking the distance over which intercommunication is required is mainly governed by the range of the artillery equipment with which they are intended to be used. For instance in the case of field artillery, with a maximum range of some 9000 yards it is probable that sets with an efficient wireless range of some 8000 yards would prove sufficient to meet the requirements of both forward and lateral communications, similarly in the case of sets intended to work with 60 pr. batteries a range of about 1400 yards

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would be necessary. It remains, however, for technical experts to decide whether one universal pattern of artillery set capable of dealing with the longest ranges would not be the simplest solution in the long run.

The necessity for establishing radio-telephonic communication whilst on the move is another point which requires settling by those ultimately intended to use the sets. For the present, although a distinct advantage would be gained, such a quality does not appear absolutely essential. Nevertheless, in view of the rapid strides which we are making in the mechanisation of the army, and the consequent increased mobility of attacking units in the future, it would be distinctly unwise to neglect this additional advantage.

6. *Future effect on artillery.*

It is next advisable to examine briefly the influence which an efficient system of radio-telephonic communication may eventually exercise on artillery equipment, organisation and tactics.

The main alteration to be expected in the case of artillery equipment will probably be an increased simplification facilitating greater standardisation. If immediate and reliable intercommunication between attacking troops and supporting artillery becomes an accomplished fact, the necessity for our present close support artillery will automatically cease to exist, thus rendering it possible to dispense with light artillery within a division. On the other hand, increased facilities afforded for siting guns in suitable sites for the tasks required of them may reduce the necessity for employing howitzers and thus render it possible to produce one equipment capable of meeting all the field artillery requirements. It is at any rate certain that the necessity for providing long ranging equipment will be accentuated.

The provision of a suitable form of transport is essential, but still remains dependent on the ultimate shape and weight of the sets, whilst being intimately connected with the present mechanisation of artillery units. One point, however, stands out clearly, namely the necessity for providing each set with its own independent vehicle; any attempt to carry two or more sets on the same vehicle must result in a considerable sacrifice of general usefulness. A small handy form of transport, capable of carrying two men and one set,

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is required. An adaptation of the Austin 7 chassis, possibly converted to a six-wheeler pattern, or a Carden Lloyd type of chassis, would appear to be the class of vehicle necessary for co-operation with infantry formations. In addition each set must be easily adaptable for pack transport when required. It would be wise, however, to look a stage further ahead, and to consider the best form of transport when operating with mechanical forces. Under these circumstances part of the close support intercommunication detachment must necessarily be transported in some form of armoured fighting vehicle capable of accompanying the attack; and if possible of communicating whilst on the move. Ultimately some such form of armoured cross-country vehicle should form part of the headquarter vehicles of a mechanised battery.

In the case of artillery organisation the main change to be expected will arise from the abolition of light artillery within the division as already stated. The financial savings thus effected should more than counter-balance the expenses entailed by the introduction of radio-telephonic equipment and its transport. It is also probable that the more general use of observed artillery support, as opposed to the present system of concentrations and barrages, will lead to a distinct saving of ammunition. To predict that such a saving may allow of a reduction in the various echelons of ammunition supply would be rash, since these already exercise a distinct limiting factor on the full development of the available artillery power in the field.

Turning to artillery tactics it is proposed in the first place to examine the future employment of artillery with an advanced guard. Assuming again that our system of radio-telephony is reliable and efficient, it will become unnecessary and undesirable to detail any guns to accompany the advanced guard, since the support required by it is that of artillery fire power applied at the right time and place. Such fire power cannot be produced by artillery on the move, the most rapid and efficient support depends on artillery being continuously in action ready to answer any call at a moment's notice. With field artillery possessing a range of some 9,000 yards, it should, when necessary, be possible to maintain a small proportion of guns always in action near the head of the main body capable of covering the van guard troops. The close support intercommuni-

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cation detachment would replace the actual guns with the advanced guard, and would maintain a small party with the vanguard. By this method any immediate calls to brush aside temporary resistance could be answered without delay, whilst the control of fire for any necessary artillery deployment could be rapidly established. The present procedure of leap-frogging sections of medium artillery would be continued, the necessary observation party being incorporated in the close support intercommunication detachment.

In the case of the attack, whether hasty or deliberate, the main difficulty lies in deciding the exact time and place when artillery support will be required. Hostile machine guns cannot be accurately located before the attack, in some cases indefinite areas of resistance may be detected, in others the whole front presents potential resistance to the attack. Since up to the present no satisfactory method has existed for controlling artillery fire from close proximity of the assaulting troops, we have been forced into unsatisfactory expedients which we have already commented on, such as concentrations and barrages.

It is probable that in the future some form of initial pre-arranged programme may remain necessary, but in the execution of this programme it should become possible to control the artillery support in accordance with the requirements of the attacking troops. The rate of advance of any artillery supporting fire could be slowed up or accelerated by messages broadcasted from the close intercommunication detachment based on observation or on close liaison with the assaulting troops. Such a procedure was repeatedly tried during the last war by light signals and other methods, but only met with failure owing to inadequate methods of intercommunication. Again, unexpected centres of resistance could be dealt with by direct calls to definite batteries, or group of batteries, held in readiness for this purpose. The resultant control of artillery power would render it possible to support attacks with considerably reduced density of artillery than is now considered possible, and to expand the limited resources of ammunition available in the field to far better effect.

It is possible that an adaptation of the present zone call system, employed with the R.A.F., may prove suitable for observers employed in the suggested close support intercommunication

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detachment. Assuming that each artillery brigade is working on a separate wave length, it would still remain possible to retain the spare set at each battery and artillery brigade headquarters, listening in on a wave length common to the whole divisional artillery. It would then be possible, in the event of a specially favourable target, for any one close support intercommunication detachment of the divisional artillery to send some pre-arranged call indicating that a concentration of fire of the whole divisional artillery was desirable, followed by a broadcast of general observations of fire. Similarly targets of less importance could be engaged by any one artillery brigade concentration on a pre-arranged call being sent on its respective wave length. The use of coloured smoke shell to assist in distinguishing individual battery or brigade fire would add to the value of observations broadcasted.

In defence the control of artillery would be greatly simplified. Heavy hostile bombardments and minor enemy penetrations would no longer disorganise the system of artillery control and observation to the extent that prevailed during the last war. Pre-arranged artillery programmes of defensive artillery fire would still be necessary, but the substitution of a system of broadcasting information of hostile movements by radio-telephony as opposed to the existing S.O.S. signals, would materially add to the resisting power of such fire. The power of artillery in the defence would consequently be appreciably increased, a factor which must be borne in mind when considering problems of the attack. Evidently under these circumstances the importance of efficient counter-battery work in the attack is accentuated, but the introduction of radio-telephony can play no great part in the solution of the complex counter-battery problems, except through the medium of the air which is beyond the scope of the present article.

In the foregoing remarks on the influence on artillery tactics we have mainly considered forces organised on an infantry basis. Before concluding it may be wise to examine the influence of radio-telephonic communication on artillery tactics when operating with armoured fighting vehicles. The main danger to tanks arises from anti-tank guns, especially of the future automatic type. That these weapons will remain hard to locate prior to an attack is a certainty. We shall therefore find ourselves confronted with a problem very

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similar to that of supporting infantry against machine guns, with the exception that operations will be of an increasingly rapid nature making the task of artillery even more difficult. On the other hand the presence of armoured mechanical vehicles in the assault should render it possible to convey an adequately protected close support intercommunication detachment sufficiently far forward in the assault to control efficiently the available artillery support. It may be argued that the same mechanical vehicles would be better employed conveying the actual gun destined to engage the anti-tank weapon. Against this argument it is put forward that the carefully sited anti-tank weapon should always have the advantage in its favour when engaging the opposing weapon, surprised in an open position, and forced to develop its fire from a moving platform with limited observation. A battery of self-propelled weapons, moving by bounds some distance in rear of the attack, with observation provided by a suitably protected close support intercommunication detachment operating in close contact with the attack, would appear to provide a far more efficient type of support. Such support, however, remains entirely dependent on future efficient radio telephonic communication capable of being established whilst on the move.

7. *Conclusion.*

Judging by the phenominal improvements made in methods of wireless intercommunication during recent years, combined with the present stage arrived at, it is safe to argue that through the medium of radio-telephony a very reasonable chance exists of solving the main artillery problem of the day. Granted that no definite promise of success is yet assured, and that at the best possibly a partial solution may only be attained; yet the problem is of sufficient importance, not only to the Royal Regiment of Artillery, but to the army as a whole, to warrant its very closest examination from every point of view and every effort towards its ultimate solution.

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BATTERY TACTICAL TRAINING.

A study of Artillery Training, Vol. III (1928).

By Bt. Lieut.-Col. E. C. Anstey, D.S.O., *p.s.c.*, R.A.

PART (1).

A CURSORY glance at the new third volume of Artillery Training discloses the fact that it is not an amended version of the old book but that it has been completely rewritten in its most important portions. The first point to which it is desired to call attention is the omission of the statement that the brigade is the artillery tactical unit.

That was a statement that had no justification and was harmful. When we speak of the platoon being the lowest infantry tactical unit we mean the smallest unit that can combine fire and movement, the basic principle of infantry tactics. Since artillery does not act by fire and movement within itself as an essential of its action, that principle is out of court. Even if it were not out of court the brigade would not be indicated as the lowest tactical unit. A battery can provide fire and movement, if you wish it, by moving by sections. If you have to name the smallest unit to which can be entrusted participation in a separate tactical operation, a battery could justify its title better than a brigade or else it must be wrong ever to detach a battery to an advanced guard. In certain circumstances a single gun can be employed on a separate tactical operation. Thus the truth of the matter is that the term "smallest tactical unit" cannot be applied practically to the artillery. We should restrict ourselves to the dictum that batteries will normally act in brigade, or as the new book has it "Control should be centralised in the highest formation that can exercise it without risk of failure in the co-ordination of the action of the batteries."

It was a harmful tenet because it acted as a drag on the development of true co-operation between the infantry and the artillery. There was a school of thought that maintained that all tactical co-operation ceased at the brigade. That fallacy should be effectively

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crushed by a study of the volume before us. The immediate consequence is the importance of the study of battery tactics. To consider the meaning of the expression and to suggest how the subject may be studied and taught within batteries is the object of this article.

Artillery Training, Volume III, should be studied with the old volume lying on one side of it and Infantry Training, Volume II, lying on the other. The first impression recorded will be the disappearance of the strong trench warfare flavour of the old book. The breath of moving warfare is on every page. It is not too much to say that the Regiment is receiving for the first time in its history sound and practical leading as to how it should be handled in the field.

Let us take the new teaching step by step in logical sequence.

(1) Organisation and Command.

(a) The definition of the terms to be used in distinguishing between the centralisation and the decentralisation of command (i.e. "under the command of" and "supporting") is a repetition of the Army Order already familiar.

(b) In 1921 "grouping" referred only to heavy artillery (p. 40); the 1928 version extends it to field artillery as well (pp. 2, 3, and 56). If two brigades are supporting an infantry brigade they are to be grouped under one commander; but it must be observed that he does not command the close support artillery under the command of battalion commanders within the brigade.

(c)) Close support guns have now been placed definitely under the command of the infantry thus bringing our manual into line with Infantry Training.

(d) The suggestion that when cable is used it may be advisable to group brigade or battery headquarters or to direct them to follow certain routes in order to simplify communications (p. 30) is new and is an adoption of a principle already practised by the other arms. It will be seen later, however, that the application of the principle must be in harmony with the still more important principle of maintaining close touch with the infantry.

(e) One of the most important steps towards the attainment of co-operation was taken when the following words were included

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(p. 42) :—"When command of artillery is not decentralised the units that each brigade and battery is to support must be precisely stated." This will ensure that each infantry commander down to the battalion will be placed in direct personal touch from the outset with a gunner whose primary duty it will be to support him in an emergency. The favourable effect of this upon co-operation will become evident later.

The corresponding sentence in the 1921 volume was as follows (p. 38) :—"Artillery commanders should be placed without delay in touch with those whose operations they are to support, etc." This was generally read to mean "artillery brigade commanders," and the inclusion now of the definite words "brigade and battery" places a disputed point beyond argument.

(f) It is now recognised that the decentralisation of the bulk of the field artillery in the later stages of an encounter battle may be necessary (p. 47). This is a phase of the attack that merits particular study.

(2) Reconnaissance.

No more serious criticism could be levelled against the 1921 volume than its silence on the subject of the tactical reconnaissance. It was not mentioned. In fact it was definitely stated on page 66 that as soon as an artillery brigade commander received his orders he proceeded with his technical reconnaissance, obtaining information from the infantry commander he was to support but not accompanying him on his reconnaissance. That he must do so now is definitely laid down (p. 32). Only thus can he ensure from the outset, as the book says, that his action is co-ordinated with that of the other weapons. This tactical reconnaissance precedes all other action.

The importance of early instructions to the signal officer is emphasised for the first time and again brings us into agreement with an essential point prominent in the training of other arms.

The 1921 volume stated definitely (p. 66) that the brigade commander would issue written orders as soon as possible and it added that if time were short he should assemble his battery commanders and explain his orders to them. It was an unfortunate expression to use, for clear orders should require no explanation. In practice

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it was obvious that in moving warfare written orders would seldom be practicable. This is now recognised and the 1928 version indicates (p. 33) that verbal orders are normal and that they will only be confirmed in writing when practicable.

Thus the art of giving verbal orders will have to be studied by us as it has never been done before. It is an art that requires much practice by brigade commanders. So much has to be included that careful study is required to discover how the process can be hastened. The naming of points in the countryside and the information paragraph alone, which are of the greatest importance for battery commanders to master in detail, may take five minutes or more. At the Senior Officer's School (India) it was found that the issue of adequate artillery orders to a brigade takes from ten to twenty minutes, depending on their complexity and on the skill of the commander. This time can be shortened by some such procedure as the following.

An artillery brigade commander reports to the infantry brigadier he is supporting either knowing nothing of the situation in the case of a separate operation or provided with the general situation as he has received it from his C.R.A. The brigadier will tell him first the points in the countryside that have been named to facilitate rapid reference and to quicken the issue of orders, names which of course the artillery must adopt too, suggesting any further ones that appear likely to be of value. These must be noted by the adjutant. What is known of the enemy and the position reached by our own troops come next and are obviously of the greatest importance. The brigadier may then begin his reconnaissance by a rapid ride along the front or to one or more view points. While the artillery brigade commander is away with him the adjutant can pass on the information he has gleaned to the battery commanders who are under cover but within call. This will shorten the brigade commander's orders when he comes to give them by not less than five minutes. Since the brigadier's reconnaissance may take half an hour or more it might be desirable for the battery commanders to carry out some ground reconnaissance, rendezvousing to meet their brigade commander at a selected point by a certain hour. On the other hand the areas in which they may have to find positions will not be known yet. The whole area allotted to the brigade will

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probably be known. But all this is a kind of "battle drill" that requires investigation.

Another point that requires investigation refers to observation of the enemy. In section 15 (3) it is stated that reconnaissance of the enemy's positions by artillery officers is specially important before an attack. The location of some of the machine guns of the defence before the attack begins might make the difference between success and failure. How this observation should be organised is not laid down in the manual and requires study by brigades.

The time required for reconnaissance of the above scope is considerable it is true. It must be remembered, however, that often the infantry will take longer to mount their attack than the artillery will require for their preparations (p. 41).

(3) Nature of Plan.

As long as our tactics are based as they are on fire and movement, a tactical plan will consist of a fire plan and a plan of movement. This holds good for the artillery provided we enlarge the scope of the plan of movement to embrace the kindred subjects of command, control, and communications (sec. 16. i.). This definition is closely followed in the manual by the new and important ruling that the plan is to be drawn up by the artillery commander in accordance with the instructions of the commander of the attacking formation. This responsibility of the infantry commander is worthy of close attention. It is seen to be inevitable if Infantry Training is studied and the reiterated insistance on that responsibility is noted. The book opens (I.T., Vol. II, p. 2) by emphasising in large print that above everything commanders must realise that to launch infantry to the attack insufficiently supported by fire is to court disaster, and it is laid down in Sec. 4. i. that it is essential to the success of an offensive operation that every commander shall organise the whole of his available fire resources to the best effect. This does not mean that the artillery supporting him need necessarily be under the infantry leader's command. Even when the artillery has not been decentralisd our manual points out (p. 42) that artillery brigade commanders will often have to arrange details of their tasks as well as of co-ordination of fire with that of machine guns and other weapons direct with the infantry commanders they are supporting.

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The co-operation of artillery and machine guns is a familiar expression. But we are now receiving clearer guidance as to how to attain that co-operation than we have ever received before. The joint reconnaissance brings the gunner and the infantryman together for the formation of the plan; the co-operation of the guns and machine guns throughout the battle is provided for by the ruling (p. 24) that when machine guns are brigaded artillery and machine gun officers must keep in close personal touch; and finally team work between the artillery and battalion machine guns is made possible by the system of naming batteries to support battalions in the manner already referred to.

The word affiliation which, be it remembered, must not be used in orders, exactly describes the relationship it is desired to establish. There are two aspects of it that require especial consideration—its feasibility and its necessity. It implies that the associated infantry and artillery commanders remain in personal touch throughout the course of the action. It is often said first, that such personal relationship is not necessary; and secondly, that it is not feasible because the first duty of a battery commander is to shoot his guns and that he will not be able to do that satisfactorily if he remains with or very near the battalion commander. It must be insisted that neither of those statements is correct.

To appreciate the necessity, it is essential to hold clearly in mind the course of a battle as envisaged by our doctrine. To find this one must turn to Infantry Training. It is well sketched in the section (13) dealing with the battalion in the attack and is summarised in Sec. 13 (18) in the words "The attack is, therefore, a methodical progression from objective to objective, involving a succession of assaults, constantly delayed for the purposes of reorganisation and of clearing the captured defences, and also by the necessity of . . . . readjusting the fire plan."

Study further the manner in which the battalion commander handles his reserve (Sec. 13. 21) "ensuring that the covering fire is sufficient" for the manœuvre he has designed for it; remember that the artillery portion of that fire has to be on the most important targets (A.T. III, Sec. 6. 3) and that the man who has to say which are the most important targets is the infantryman for he has to "indicate clearly where and when artillery fire is required" (I.T. II,

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Sec. 5. 5); and then consider whether any other than personal communication between the two is likely to be effective.

Those who maintain that a battery commander cannot accompany a battalion commander are often ignorant of how the latter conducts his fight. A battalion headquarters is a big affair, it is true, and has to be for the most part under cover. But the battalion commander himself has to rely on personal observation (I.T. II, Sec. 13. 20) as well as on reports, and the view he requires is exactly the same as the view required by the battery commander. Moreover it will be found that their respective moves will correspond both in time and place. The importance of their close proximity is so great that no effort should be spared to attain it. In no other way can we ensure that the guns, after the programme arranged for the initial attack, will fire on the targets of greatest importance; and, as a General said recently, an artillery of indifferent accuracy firing on the right tactical target is of more value than the most accurate artillery firing on the wrong one. Great indeed is the danger of allowing gunnery to overshadow tactics.

Reviewing, therefore, the course of an attack as painted in Infantry Training, we see that there is no such thing as an artillery tactical problem as distinct from the tactical problems of the other arms. They all combine to form a whole. Tactical problems in which the gunner is involved during an attack may be those connected with :—

(a) The initial fire plan.
(b) The readjustment of this fire plan during the progress of the action.
(c) The concoction of a fresh fire plan to support the local action of a battalion's reserves.
(d) The concoction of a fresh fire plan to support the action of a brigade's reserves.
(e) The hasty production of a defensive fire plan for a captured locality.
(f) The action of a brigade or battery decentralised in the late stages of an attack and coming under the command of a brigade or a battalion.

The further an attack progresses in fact the more the responsibilities of a battery commander veer from fire control to tactical

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control. But battles are lost and won in the later stages of an attack. Hence the importance of tactical training within the battery.

The formation of a fire plan therefore deserves more attention from battery officers than it has hitherto received. Practical guidance as to its formation will be found in Secs. 17 to 21 of the new book. Notice first of all that artillery preparation is now referred to as a possibility in moving warfare; and secondly that the statement "barrage fire is impracticable" (1921, Sec. 40. 3) is replaced by the admission that barrage fire on a very limited scale, limited in duration, frontage and depth, may sometimes be the simplest method of giving support when the enemy's position is not known accurately. It is the only way to give support, for instance, to the assault, on an enemy on a reverse slope and thus out of sight of all O.P's.

At the top of page 45 the very important fact is pointed out that if you cannot see the hostile machine guns you will very frequently be able to deduce the areas they must be in and so neutralise them with fire or blind them with smoke. Remember, however, that a blinded machine gun is not neutralised; it can continue to fire on its pre-arranged task. But its activities are confined to that task of plastering a very narrow belt of ground with bullets, a strip that, once located, can be closely approached and crossed rapidly when the fire stops as it must do at frequent intervals. We have only to remember that the failure of nearly every attack is due to machine-gun fire and we must realise the vital importance of studying by every means in our power the problems of destroying, neutralising, or blinding those weapons in the attack, not after they have disclosed themselves, but before they have been able to surprise and take heavy toll of our infantry.

A time programme receives more attention in the new volume than it did in the old. Obviously in an encounter battle the problem of ammunition supply is a dominant one in the duration and nature of the artillery support to be given. That is why at the Senior Officer's School in India infantry officers are taught that the first invariable question they should ask of artillery officers coming under their command during the course of a battle must be "What ammunition have you got?"

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The value now attached to smoke has brought that form of fire from the shadows of a subsidiary chapter on special shell straight into the limelight of Sec. 21. Thus the subject is given the same importance as that accorded it in Infantry Training. Its indicative uses, i.e. indicating directions, frontages, or times, are worthy of remembrance. On occasion the difficulties of maintaining direction may be greater than those of overcoming the enemy.

4. The formation of a fire plan.

Having mastered the nature of a fire plan, the question arises as to how we should set about forming one. Does the gunner suggest one to the infantryman, or the infantryman suggest one to the gunner, or is it a joint production of the two?

It will be remembered that the infantryman is taught by his manual that it is his duty to indicate clearly where and when artillery fire is required. The extent to which he does this depends of course immensely on his personality, ability and knowledge. In practice it will sometimes be found that the best and quickest course will be to get as much as possible from the infantryman and suggest the remainder. In extracting what you want from the infantryman there are two lines of thought you will probably find it profitable to put before him.

First ask him what plan of movement he has in his mind and what alternative plans there are. With the present standard of training of the infantry you will not often find that he has already decided on his plan of movement before considering the fire plan. If he has done so you will know that he does not understand his job. For the selection of the plan of movement depends on adequate supporting fire being forthcoming. With the plan of movement in mind, ask him where he proposes that his supporting machine guns should fire and where he would like to see shell bursting at different stages of his advance. Put to him in this way the infantryman will often find the problem of saying what artillery fire he requires much simplified.

Another useful line to take is to think in terms of natures of fire, i.e. destructive, neutralising, blinding and indicative, and put the questions: Is there anything I can destroy for you, e.g. a house,

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machine gun, trench, wire? Is there anything I can neutralise for you, e.g. a trench or an area with shrapnel fire? Is there anything I can blind for you or screen, e.g. the enemy, yourself, or an area empty of attacking troops? Is there anything I can indicate for you, e.g. direction, forming up lines, timings, etc?

As soon as you have obtained the infantryman's wishes at once calculate roughly the ammunition that will be required and see whether its provision will be possible. In most cases the next step will be to cut down the proposed programme in some way on this account, or to work out how the available machine guns can work in with you to provide the fire required.

It will often be found, however, that the number and extent of the targets the infantryman wishes engaged are excessive and beyond the scope of the supporting weapons available. It is then necessary to ask him to say which targets are the most important. The temptation for the gunner of course is to fire on the easy and ignore the hard ones. When the important target is a very difficult one to range on it may be necessary to ask the infantryman "Would you rather have inaccurate fire on the important area or accurate fire on the less important?" In any case it must be for the infantryman to decide which are the most important targets.

5. Close Support.

The placing of guns in close support of infantry definitely under their command has already been noticed. Another new ruling of great importance is contained in Sec. 19. 3, where it is stated that field artillery is also used for that purpose to replace or reinforce the light artillery. This brings close support into the tactical orbit of the field battery and is a fresh call for the study of tactics by battery officers. Even the 4·5″ howitzer is noted (p. 12) as useful as a close support weapon.

The functions of close support artillery are to deal quickly with unexpected resistance (Sec. 19. 1), to engage an enemy tank counter-attack, and to fire on the hostile anti-tank guns (Sec. 19. 5). The initial difficulty is to get the guns far enough forward to carry out these tasks. In the first stage of an attack their role should be a waiting one. Keep your guns handy to the brigadier or battalion commander under whom you have been placed, acting

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as a reserve of fire power in his hand to be applied if things go wrong by engaging small targets onto which the fire of the field artillery cannot be turned sufficiently quickly or because the guns are otherwise engaged. When the enemy's foremost localities have been captured a covered approach will often be found by which the close support guns can get forward. The closer the country the more call and scope is there for such support. In hedgerow fighting, in the outskirts of towns and villages, in woods, and in broken country, numerous opportunities will be offered for working a gun or guns right forward and disposing of a little centre of resistance by one or two shells fired at short range. The greater the penetration into the enemy's defences, the more the close support gun comes into its own.

In devising a little fire plan for the support of a platoon or company attack see to it that you co-operate not only with any forward machine guns that may be present but also with the other infantry weapons, each taking on the targets its characteristics most suit it for. Of these the one most often forgotten is the rifle grenade, a powerful and (in skilled hands) most effective weapon. It now has a maximum range of 325 yards (I.T. II, Sec. 3. 10, as amended by A.O. of January, 1927). Both H.E. and smoke grenades exist. It can often be arranged for them to deal with targets within their range, freeing the close support gun to engage those further away, such as machine guns wide on the flanks. Remember that the Lewis gun must not be used for overhead fire except in very favourable conditions, such as, say, across the bed of a deep ravine. If you want to suggest how the Lewis guns can help, look for positions from which they can deliver flanking fire. Never engage a target with close support guns if you find that you can arrange for equally effective fire from the supporting artillery in time. Your ammunition supply is likely to be so difficult that you cannot afford to waste a round.

6. Battery Tactical Training.

It is easy to say what a battery commander ought to teach. It is difficult to find time to teach more than he does already. Brigade tactical training during the winter possibly claims some of the time and energy of himself as well as of his officers. It may

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seem beyond bounds to suggest that he should work out schemes on a similar scale for his officers and N.C.O's and conduct them in the manner laid down in Training and Manœuvre Regulations. In many stations the ground suitable for such training is confined or the distances to be traversed to reach it considerable.

All this is very true. A great deal of valuable teaching however can be given with a minimum of time and trouble on a suitable sand model. One is independent of the weather and of any restrictions of ground; odd periods of time can be utilised and especially spells of bad weather; the instruction can be broken off if necessary and resumed at a more convenient moment; and the effort required to produce the scheme is reduced to very little.

The table should be larger than that usually employed. The limiting factor to size is the ability to reach its centre to model the ground and to move blocks. Small square blocks of wood should be made to represent the following:—

Limbers, guns, and wagons with hooks and eyes to allow limbering up. Size about ½″ cubes.

B.C.—Tptr.—G.P.O.—Section Commanders—B.S.M.—B.C's party—B.Q.M.S.—Farrier—a few spare. Size ¼″ cubes.

"A" group—"B" group. An intermediate size.

Prepare two scales as follows:—Put the above battery in column of route and call the distance 450 yards. This scale is for use in studying battery manœuvre into and out of action. Another scale should be at one foot to 1000 yards for tactical schemes. The blocks then, of course, are not to scale and the battery occupies too much room in action. But this does not matter.

As we have seen, you cannot divorce artillery from other tactics. Infantry and artillery tactics are inter-dependent. To study one you must study the other. We have to be familiar with the handling of infantry in order to be able to assist intelligently in their support. We need to teach first, therefore, how a tactical problem should be approached. How to carry out a reconnaissance is the primary lesson.

To solve a tactical problem rapidly and efficiently in war requires method. That method is really present in all we have learned about appreciations of situations. But that expression means nothing to our N.C.O's and probably means the wrong

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thing to our officers. It has an academic flavour divorced from reality. We require therefore to clothe the process of appreciating a situation in a practicable garb.

Before you can solve a tactical problem you must be able to specify accurately what the problem is. You cannot do that, whether you are a brigade commander or a platoon commander, until you can answer the following questions:—

Where have I got to get to? (Object.)

What is the nature of the country I have got to cross to get there? (Ground.)

What is going to stop my getting there? (Enemy.)

What force have I got to get there with? (Own troops.)

Take the simplest problem to start with—the action of a company's reserves of one or two platoons in the late stages of an attack, supported by a sub-section of machine guns and a section of 3·7″ howitzers. Devise a bit of ground reached by the leading platoons of the company with a sufficiently covered approach to make it reasonable to suppose that the close support guns can have got up as well. Place the enemy in some confusion as can be expected at such a stage of the battle, at distances of 200 to 600 yards. Make the flanks of the leading platoons secure by the presence of other troops. Decide how much of the enemy the company commander can see from the best view point he can reach. Say what his original orders were, for preference giving him some objective beyond his strength to attain in order that he shall have to select an objective that he thinks he can reach. Paint the condition of the forward platoons, one let us say in considerable confusion with a Lewis gun knocked out, the other in good fettle but pinned to the ground it has reached by a belt of machine-gun fire across its immediate front. At this stage of the battle the enemy's artillery fire may be expected to be ragged. The two reserve platoons should be in good condition safely tucked away in cover from which they can be moved in any direction. Put the 3·7's similarly under cover about 1000 yards back with a covered line of approach forward. It can be part of the problem to decide whether they ought to be moved up or not. It will be better for a first problem to put the field artillery out of the picture. Say that the O.P's are moving forward and have not yet got touch or that they are busily engaged on another portion of the front.

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Each student is now the company commander, artillery section commander, and machine-gun sub-section commander rolled into one. Show him the point he reaches for his reconnaissance and paint the picture of what he sees as he pokes his head cautiously out. Encourage him to ask any questions in amplification of your picture.

The lesson to rub in at this point is the necessity for method in carrying out the reconnaissance. Ask yourself the above questions in the order given and refuse to allow your attention to be distracted by other matters, however interesting they may be. The temptation is to look for the enemy and to waste time in watching any you see, whereas you may find eventually that they do not concern the attack as you finally plan it. Avoid such waste of time and aim at controlled thought. As soon as you have located on the ground where you have got to get to, examine methodically the intervening terrain and try to assess the tactical significance of every feature. Train yourself to take the ground to your immediate right front first and work round clockwise, or nearest the enemy first and work counter-clockwise. It does not matter which so long as you adopt a method and stick to it. Say to yourself "There is a deep ditch running towards the enemy. What is the tactical effect of it? It peters out in 200 yards and thereafter the ground is open. Therefore it is not a line of approach; but I could get a Lewis gun along it to a good fire position at the end. That belt of trees shields the view from the left of this ridge. Therefore I can only give overhead covering fire from the right flank. That rising ground to the right front commands the ground up to that rise, to the left of which, however, I should be defiladed. The area of greatest tactical importance is over there, crowned by the copse. Such being the terrain in my front, where is the enemy in it?"

In this quick appreciation of the tactical significance of ground lies most of the art of reconnaissance. If the military value of a feature does not spring to the eye at once, it is often useful to ask oneself what difference it would make if the feature were not there. Ignoring the ground is one of the commonest faults and no time spent in underlining its importance is wasted. It will often be of value to alter a few features on the model slightly and show how the whole problem is altered.

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The question of the whereabouts of the enemy should be subdivided as follows :—Where has he been seen in person and in what strength? Where can we deduce that he must be? Where are his machine guns likely to be? Where will his bullets be likely to fall? Where will his shell be likely to fall?

To complete the factors you should review rapidly in your mind the resources available, a platoon there disorganised but capable of giving a little covering fire or of holding its ground; so many fresh platoons there; so many machine guns, rifle grenades, close support guns, and shells.

It will be easy to point out how completely the problem may be altered by a few changes in the above answers. Consequently it is not until you have reached this point that you can say with confidence that you know what the problem is you have got to solve, and that you are ready to consider what possible plans of movement there are.

The problem must be so designed that there is more than one possible plan of movement. That which can best be supported by fire is of course the one to select. The next step, therefore, is to take each plan of movement in turn and consider what fire would be required to make it possible. Where would you like your fire to be falling as your men go over that area? is the way to put it to yourself. You decide that you must have fire on points A, B, etc., to F. But you have not got enough weapons to engage all of those points. On the other hand by moving another way you will be defiladed from C and E and your covering fire will therefore be more powerful. How are you to apportion it? Start with the rifle and Lewis gun fire first remembering that it must not be overhead. You must attack to one side or other of it. Then see whether there is any small target such as an automatic rifle or machine gun within rifle grenade distance of any ground you can reach under cover. Next consider what the machine guns can fire on with most effect; and finally examine whether the close support guns can deal with the remaining targets. If you have arranged in the problem that one of these targets is unsuitable for close support guns owing to its extent or nature, then bring up a field artillery observer at this point and see whether the student arranges with him to take on the right target.

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The result is now a properly co-ordinated fire plan applied to a suitable plan of movement. The manner in which it has been arrived at is exactly the same in form for a brigade attack as for a company attack. There is nothing really very complicated about it as long as it is approached in the methodical manner sketched out here. But it will be readily seen how closely related the plan of movement and the fire plan are and how impossible it is to consider the one separately from the other; and, consequently, how closely the gunner and the infantryman have got to work together. Of what value would be the gunner's co-operation in the little problem we have just sketched out if he were judging the situation for himself half a mile away and trying to arrange for some measure of co-operation by means of runners, signalling, or even cable, with the harassed company commander instead of being on the spot?

Such close support problems are excellent introductions to the subject of tactics. Battery tactics can be worked out on the sand model equally well; and if these problems are made true to war and endowed with some life it will be found that a great deal of instruction can be given without going outdoors at all.

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THE REAL BRITISH ATTITUDE TOWARDS AFGHANISTAN.

By Lieut.-General Sir George MacMunn, K.C.B., K.C.S.I., D.S.O., Colonel Commandant.

IN THE popular conception Afghanistan has been a country cut off from India by a barrier of difficult mountain ranges, through and to which the British officer was practically forbidden to peep, and therefore there has grown up a conception in Great Britain and even in British India of a country and a people somewhat like that garden at the end of the passage which Alice saw in Wonderland before she nibbled at the magic mushroom.

Further do we, misled by the goody-goody type of Victorian historian, believe that at one time we have treated Afghanistan disgracefully and deserve to sit in a white sheet for our pains.

Both these conceptions are entirely wrong, and the proper way to consider the problem, and read the daily reports of the young King pouring new wine into old bottles, is based on a more correct envisioning of both past and recent happenings as well as a true picture of what may yet have to be faced.

A man cannot get away from his shadow and a people can not get away from its past, neither can a politician deal with a situation unless he knows how that situation has arisen.

The distant past.

The problem, like all those of Asia or, indeed, that of any country, cannot be read apart from its distant past. It may safely be said that when the Aryan races moved from the grass uplands of Central Asia and came to lands which developed them into an agricultural and abiding people, they crossed the Oxus and first peopled the country which we now know as Afghanistan. Further, many hundreds of years later, even in the days of Persia's greatness and the Persian Empire of Darius, this land was Aryan, even though the Aryan race had covered the *doabs* of the five rivers and had flowed far down the Ganges plain and into bits and pieces of the Deccan. For hundreds of years the great walled fortress

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of Balkh had been the principal point on which the Aryan races had stemmed the Tartar and Mongol press, and kept Ariana as Ariana. When Alexander of Macedon succeeded to the power and provinces of Persia it was Aryan Balkh and Aryan Kabul that had welcomed his rule and it was the Aryans of Afghanistan that his young western Aryans had organised as levies and light troops, exactly as the young Aryans of Britain lead the eastern Aryan to this day. Now the upshot of this is that in the time of Alexander, and in the days of the Greekish kingdoms of Bactria and later of the Upper Punjab, all this country from the Oxus down to the Ganges was in the hands of the same people always, excepting the pockets of Dravidian folk, Dards and kindred peoples which the Aryan pushed into the side valleys of the Central Asian and north Indian world.

In the days of the great Hindu kingdoms of Maurians and the like, Afghanistan was part of the warp and weft of their realms, of their principalities and overlordings and of their uprisings. From the Oxus to the Sutlej and far down the Ganges the races and the religions were more or less as one. The Buddhist reformers carried their philosophy wherever the Aryan peoples dwelt before the Tartar races caught the principle and kept it.

The History of the Afghans.

As the barriers of Balkh weakened, Tartar invasions and inroads came through, slipping along the Himalayan valleys or raiding forays far down into the plains, but Aryan the mass of the people remained. Then came Islam onto a weakened world, the faith of Submission to the Will of God, no new thing, but preached in new ways to peoples who had forgotten. With Islam came the astounding uprising of Arab dominion, and with Arab dominion a new set of invasions. And among the settlers in Southern Afghanistan came a tribe or a people who called themselves the descendants of one of the sons of Saul, Afghana by name, and who at one time or other in their history began to call themselves the Ben-i-Israel or the Children of Israel, and therefore a bit of one of the "lost tribes." Whether they be of Israel or whether they be of Judah, or whether they be merely Arab, there is no sort of evidence. Physiognomy points to Judah rather than to Israel, for

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the hooked nose comes by way of Judah whose commerce with Moab gained the guerdon of the Hittite nose. But though evidence is scarce, the story is more than possible. The Afghan names are those of Israel and Judah but give no real clue, since Arab names are all the names of Scripture—Jesus, Joseph, Abraham and the like. As a mere matter of trek there is nothing in it. To slip a few hundred miles in the course of centuries, through Khorassan by way of the valleys that run accessible would be nothing at all.

But whether the Afghan proper has any real claim to be the Ben-i-Israel, or no, it is pretty patent that the genealogy of the *Pakhtan-nama* whereby all the tribes of the Sufaid Koh and the Suleimans claim relationship to Afghana is largely bogus and the result of fashion pure and simple. Some of the so-called Afghan tribes are undoubtedly Afghan, that is to say branches of the folk who settled in the early days of Islam or just before in mountains of Ghor and in Zemindawar in what men now call Southern Afghanistan. But there is every reason to believe that many of the frontier tribesmen are pure Aryan, and Rajput at that, who, as so many of the Rajputs of the Punjab have done, have embraced the fashionable and edifying faith that rolled up from Arabia. Furthermore the Alexandrine historians called the people who lived in the Khaiber, *Aproetæ*, and those who spoke Pushtoo or Pukhtoo *Pactydæ*.

The force of this point is the emphasis that it puts on the homogeneity in essential principle of Afghanistan with Aryan India.

Afghan invasions of India.

From the earliest days of the Christian era, certainly since the days of Islam, India has been subject to invasions from and through Afghanistan, and constantly, conversely, do we find Hindu princes and generals leading Hindu armies up to Kabul, to Kandahar and to Herat. Ever since Mahmud of Ghuzni a thousand years ago started the fashion of Islamic domination of Northern India, we have seen the Afghan and Pathan tribes hack their way to land and power as colonisers. To this day Moslems so far south as Hyderabad know well the Afghan or Pathan clans from which they are descended. For long periods at a stretch all or parts of Afghanistan

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have belonged to the Delhi throne. In more modern times Baber, of Tudor parallel, was king of Kabul before he conquered India. Afghan dynasties from time to time have ruled at Delhi and over the kingdoms of the south and west. In Mogul times, Afghan generals and armies have even played kingmaker at Delhi. Delhi has summoned to its aid the forces of Kabul so recently as 1761, when the Mahrattas were defeated with heavy loss at the last of the many battles of Paniput. After Nadir Shah, the Persian Turk who conquered Delhi less than thirty years before Paniput, the throne of Kabul separated once and for all from the throne of Delhi, and the Duranni dynasty and Empire was founded by one Ahmed Shah of the Afghan tribe of the Abdallis. Now this is the important point to remember in connection with the future, viz.: that the Duranni Empire extended to the Sutlej and included Sindh and Karachi as well as Kashmir, so late as 1797. In that year in return for services rendered the Afghans gave Lahore in feudal fee to young Ranjhit Singh, the brilliant young horse soldier who was to acquire dominion over a large portion of the quarrelling Sikh confederacies.

Between 1797 and 1837 Ranjhit Singh acquired by what was originally revolt against his suzerain, the whole of the Punjab, including at different times, Kashmir, Multan and Peshawur, while Sindh had almost broken away from its position as an Afghan province owing to the internecine quarrels among the Afghans which had so weakened their power. But when the British in 1803 came to the Sutlej, that river was at any rate nominally the Afghan frontier.

In connection with the inroads of Hindu forces into the Suleimans and Afghanistan in the past, it is interesting to remember that the British Government in 1842 were quite prepared to give Rajah Ghulab Singh of Jammoo, the great-grandfather of Mr. "A", the country from the Indus to Jellalabad, and that in 1897 Rajah Sir Pertab Singh offered to take over the Afridi Tirah and run it as a Rajput jaghir. We laughed at the idea but it was based on good ethnology and sound historical precedent.

Moslem principalities in India till so recently as 1848 looked to Afghanistan to come to their succour. Tippo Sultan openly appealed to Zeman Shah, the King of Kabul, to come to his assist-

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ance as a fellow Moslem of India against the British. 5000 Afghans came to aid the Sikhs and their Moslem troops against Lord Gough and were chased from Goojerat to the Khaiber *ventre à terre* for their pains.

Till well on in the early nineteenth century, Hindu mothers in the Punjab would threaten their naughty children with the Afghan. And from 1803 onwards the fear of an Afghan invasion, and at one time an Afghan-Napoleonic invasion, was a very definite apprehension on the part of the Government of India, only mitigated by the severe disorders in Afghanistan and the feebleness of the successors to the Duranni throne.

THE FIRST BRITISH CONTACTS WITH AFGHANISTAN.

The British are a trading people, and the East India Company was a trading corporation. Further, the British had always wanted peace and order and trade and were only picking up the pieces of the broken Mogul Empire as far as safety or the need for law and order compelled them. They were ardently wishful for their frontier to stop at the Sutlej. A peaceful Punjab with the five rivers open to trade by sailing vessel and the newly appearing paddle steamer, was their ambition. They wanted trade with the Punjab, they wanted trade with Afghanistan, they wanted trade with Central Asia by way of the Indus and the Afghan passes.

In 1811 Mr. Elphinstone, of the Indian Civil Service, took a trade mission to Lahore and to the Afghan city of Peshawur, where he saw the Shah, Shah Soojah Ul Moolk, and learnt more of the bitter quarrels between Duranni brothers and Afghan chiefs that so militated against trade. In 1837,[1] Captain Alexander Burnes took another trade mission to Kabul, now the Afghan capital. All the Punjab had been lost to the Sikhs. Shah Soojah's attempts to recover his provinces had but added to the hindrances to trade, and now for many years the Duranni family had been driven from the throne they could not hold. The Shah after many vicissitudes was a refugee in British India, and the tribes had placed one Dost Muhammad, of the powerful clan of the Barakzais, on the throne of the Abdalli.

During these years since the Sikhs had driven the Afghans from

[1] He had travelled in Afghanistan and Central Asia previously.

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the Punjab, there had been constant attempts to recover the lost provinces, and the prospects of trade were much disturbed thereby. Captain Burnes had found that the old fear of the Russian advance and Russian influence at Kabul was on the increase and that a Russian mission had arrived at Kabul, or as men then wrote it, Căbool. Then it was that the clever men who watched over British Indian policy at Calcutta who had long known all the story of the Russian menace and the internecine quarrels of Afghanistan conceived their great policy, of killing three birds with one stone, viz.: the Russian influence, the Afghan quarrels so injurious to trade, and any enmity to British influence by restoring to the throne of his fathers Shah Soojah ul Mulkh, their refugee guest at Ludhiana.

In many ways it was a masterly policy quite in keeping with the spirit of the times. We wanted a peaceful friendly Afghanistan strong enough to escape crumbling before Russian pressure. A treaty of alliance between the British, the Shah and the Sikh ruler of the Punjab would kill all the birds nicely. Nor was the policy unbenevolent. Afghanistan was torn with the most horrible series of murders and outrages among its nobles. We would give it peace. Nor were we doing what we had no right to do. Afghanistan had long mingled with India, had invaded, plundered, tortured at will. To restore the rightful ruler in the interests of peace and goodwill between Afghans, Sikhs and British was obviously permissible if not desirable. Even as an act of invasion which it was not, it would have been but fair return from India's side.

But invasion in an arbitrary and hostile sense was not contemplated. The Shah had raised troops in the Punjab before in an attempt to recover his throne. He should do so again, but this time his Indian contingent should be armed and trained by the British and India would lend him British officers. A Sikh and British force would support the Shah, see him, if need be, on his throne, and then leave him there if all be well, with his own Indian force which would be augmented by Afghans.

Further argument for the policy was adduced by the fact that Persia, in prosecution of an age-old struggle, was threatening Herat and must be driven back.

Had this policy been successful, probably not one word of

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criticism could have been raised. Unfortunately the premises *were not correct.* Neither did the Afghans intend to have the Shah at any price, nor had he character enough to stay on the throne on which we had put him.[1] Yet all went merry as a marriage bell. The Shah and his contingent with a supporting British force occupied Kabul, and for two years the British were in more than friendly occupation. Yet more and more it became apparent that we could not leave the Shah. There is no need here to follow the political embarrassments that overtook us; everyone was in a false position, and some curse fell on every military action. Though we were eventually victorious we had entirely torn up the possibility of a friendly Afghanistan and had left a sad trail of war and hatred behind us. The only essential points to remember in this tragic story are these:—

First that Afghanistan and India have always been closely related for weal or woe, by every sort of bond;

Second, that we went to Afghanistan to create a strong, friendly and peaceful country, and despite our failure we achieved that result in some sort for over thirty years.

THE SECOND AFGHAN WAR.

The Second Afghan War was once again waged to secure a friendly and powerful Afghanistan between India and the Russian. After the final settlement of the Afghan affairs in 1842 and the replacing of Dost Muhammad on the Kabul throne, it was many years before Afghanistan went wrong. But the death of Dost in 1863 was the signal for those old quarrels between princes, brothers and barons. The Amir Sher Ali, who had finally made good his seat on the throne, had commenced his intrigues with Russia, and Great Britain found herself almost unavoidably involved in another war. The outcome was the placing of that strong and ruthless ruler Abdur Rahman on the throne, with a definite British subsidy and British military support in various forms. From 1882 till 1901 Abdur Rahman maintained himself as that strong buffer which we desired and was succeeded by his equally strong son Habibullah. From 1882 till the Great War many and great developments and even disagreements took place between the British and Kabul, but

[1] Perhaps the main gravamen of the charge against the men of those days is that they too were aware of this before the final start, but would not hold up all that had at last been arranged.

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all in the way of arriving at a modern frontier, and modern conventions that would remove all causes of friction.

During the World War Habibullah in the face of many strong inducements to throw in his lot with Turkey remained our steady good neighbour. We had after all our difficulties succeeded still in keeping Afghanistan strong, prosperous and friendly, despite the unavoidable disagreements which at times must crop up between neighbours. And we had thrown the whole of our diplomatic weight and organised many of our forces for the definite purpose of preserving intact the frontier of Afghanistan in the vicinity of the Oxus. Our policy has never changed and has rarely faltered. Thus again the two points already insisted on stand out, the inseparability of Afghanistan from India, and of Afghan interests from Indian interests.

THE THIRD AFGHAN WAR.

Just as the World War finished, the staunch and faithful Habibullah was murdered, and his son, Amanullah secured the throne. For reasons not yet historic, the young Amir elected to tear up the record of friendliness and to launch his armies on British India, then in the throes of demobilisation, and just recovering from rebellion. As soon as the British recovered from their surprise, for such a thing had not happened since the days of Zaman Shah in the early nineteenth century, the Afghans were hurled back with contumely, and had we not been tired beyond belief by the World War we should no doubt once again have sent an army to Kabul as the Amir deserved. We forbore and made some sort of peace based, however, on our desire for the strong friendly Afghanistan of our ancient policy. The young king, as we now agreed to call him, has since devoted himself to holding off Russian intrigue and modernising his mountain country, as large as France but with a quarter of the population and not a tenth of the revenue.

THE FUTURE.

What we all want to know is the future. Can the young king westernise his conservative folk as fast as he desires? Will his measures arouse more enmity than he can stand up against? And if he does well, and we can have this strong and friendly country continue, what then? Russia is using all her endeavours to turn the country against us and use it as her lever to overthrow the British

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Empire. It does not perhaps matter. We and King Amanullah probably understand each other enough to defeat such knavish tricks. But far, far more important is what is to happen if "some craven hearted pilot drives our galley on the rocks." If our Government here, and our servants in India are going to give way, beyond reason as many fear, to the hot air merchant in India and give up the marvellous structure we have build with 200 years of endeavour such as the world has never seen before, at the bidding of those who cannot possibly handle the situation they seek to develop, what then?

The *Times* correspondent with the Simon Commission last spring, blurted out for the first time on record what has been known to all observers who have been behind the scenes for some time, viz.: that the spiritual home of the Punjab is where it was a century and a quarter ago, viz.: at Kabul rather than at Delhi in which a Hindu Government is allowed to monkey with an Empire. The Punjab has over forty million people, of whom the Sikhs, men, women and children, do not exceed three millions. It has belonged to Kabul recently as the East counts time, as has been shown, and in certain eventualities is prepared to belong there again. Further there is the province of Sindh, which more recently even than the Punjab has been a province of the Duranni Empire, and it contains the only seaport possible for this country, which even in its present state is as large as France—and Sindh, like the Punjab, is largely Moslem with not the least love for its Hindu neighbours.

In the slang of the moment, "What about it?" The answer is "watch it!" which is rather more forcible than "wait and see." Young King Amanullah is probably wise enough to know, as does our Government, that a strong Afghanistan and a strong British Government can keep off each other's grass fairly easily. But a strong Afghan Government and a tottering over-developed and under-controlled lawyer-run India, which some tell us is likely soon to come about, is quite another matter. Under such circumstances with the Punjab looking to Kabul in all seriousness, we shall have let a situation come about that may be impossible to handle, charm we never so wisely, when it is too late.

In days gone by the British knew when the time had come to call "Hold, Enough!" Have we lost that faculty. *Le Bon Dieu sait.*

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LOUISBOURG 1745 AND 1758, AND HISTORICAL RETROSPECT.

By Major-General J. C. Dalton, Colonel Commandant R.A.

THERE are various accounts by eminent historians of this famous siege—now 170 years old—which was of considerable importance, coming as it did to revive the national spirits just when the military reputation of Great Britain was under a cloud—due to a number of unsuccessful expeditions which had drained the resources of the exchequer as well as the blood of many brave soldiers.

It therefore needs no apology to make these dry bones of history once more to live, by relating the heroism of our naval and military forebears in what was a brilliant feat of arms, brought about by a particularly happy co-operation between navy and army—not, alas! always the case in other expeditions of those days and the succeeding half century.

Before, however, proceeding to describe the particular event which is the subject of this article, it will not I hope be amiss, for the sake of those who may not be well versed in the military history of the latter part of the 18th century, to preface our story by some historical facts drawn from unimpeachable sources.

As several units of the Royal Artillery are concerned with the operations dealt with in this paper, I propose now to give the Muster rolls so far as they can be traced, which have been furnished me by the kindness of Lt.-Col. J. H. Leslie, late R.A., viz:—[1]

Captain Thomas Ord's Company, 2nd Battalion, R.A.

This Company was mustered at Halifax, Nova Scotia, on 2 May, 1758, and in June in Gabarus Bay "In the several Ordnance transports."

It disembarked in June, and on 1 July and 1 August it was

[1] All numbers in brackets refer to "Kane's List" numbers.

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mustered in "Camp before Louisbourg," with the following Officers:—

Captain.	Thomas Ord (54). On the Continent.
Captain-Lieutenant.	Andrew Ferguson (155).
1st Lieutenant.	Alexander Johnson (207).
2nd ,,	William Johnstone (226). Halifax.
Lieut.-Fireworker.	George Rochfort (253).
,,	Robert Fenwick (290).
,,	Thomas Johnson (291).

With 16 N.C.O's., 21 Gunners, 61 Mattrosses, and 2 Drummers.
Total, all ranks, 105.

The Company returned to Halifax in August (1758).

It was reduced in 1819, reformed as No. 9 Company, 2nd Battalion, R.A., in 1848, and is to-day represented by 18 Heavy Battery.

Captain Philip Webdell's Company, 1st Battalion, R.A.

This Company was mustered at Woolwich, on 1 January, 1758; on 1 May at Halifax, and on 1 June, in Gabarus Bay, Cape Breton Island, "in the several transports." It disembarked in June.

On 1 July it was mustered in "Camp before Louisbourg," with the following Officers:—

Captain.	Philip Webdell (115).
Captain-Lieutenant.	George Lewis (176). On command in Nova Scotia.
1st Lieutenant.	Joseph Walton (188).
1st ,,	John Williamson (219).
2nd ,,	Peter Traill (221).
Lieut.-Fireworker.	Benjamin Cock (252).
,,	William Congreve (260).
,,	Bisby Lambert (283).

With 14 N.C.O's., 20 Gunners, 59 Mattrosses, and 2 Drummers.
Total, all ranks, 101.

The Company remained at Louisbourg until June, 1761, and then proceeded to New York.

It is represented to-day by 4 Heavy Battery, R.A.

Captain John Godwin's Company, 2nd Battalion, R.A.

This Company was mustered at Sandy Hook on 1 May, 1758.

On 1 June it was in Gabarus Bay—"On board the several Ordnance store-ships." It disembarked in June.

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On 1 August it was mustered in "Camp before Louisbourg," with the following Officers :—

Captain.	John Godwin (66).
Captain-Lieutenant.	Thomas Howdell (165). On the Continent.
1st Lieutenant.	Thomas Collins (186).
2nd ,,	Thomas Simpson (227).
Lieut.-Fireworker.	John Benjamin (261).
,,	John Simpson Spencer (263).
,,	William Orcher Huddlestone (277).

With 14 N.C.O's., 20 Gunners, 57 Mattrosses, and 2 Drummers.
Total, all ranks, 99.

The Company remained at Louisbourg until September, 1758, and then proceeded to Boston.

It is represented to-day by 6 Heavy Battery, R.A.

PART I.

Fortescue tells us that after the Peace of Utrecht, 1713, by which Great Britain acquired Annapolis (Nova Scotia) and Newfoundland, the French, in the first quarter of the 18th century, had become firmly established in Cape Breton (39 miles from Sydney), and the English garrisons in America had been reduced to the dangerously low level of some 1,000 men.

Further, the French had commenced to be aggressive, and had fortified, at huge expense in 1719, the town and port of Louisbourg which they boasted was to become the "Dunkirk of America." This was a menace both to Nova Scotia and New England—but they failed to realise that without command of the sea a maritime fortress was of little value.

The French also built other forts in Eastern Canada, Niagara, etc., and in 1744—the year of the war of the Austrian succession and also of the declaration of war with England—they became still more active, and inflicted reverses on the British in Nova Scotia and Boston.

The above was too much for the British colonists who, "with superb audacity" decided to attack the French stronghold of Louisbourg which mounted 160 guns and had a garrison of 1,200 regular troops. The prime mover in this decision was William Shirley, the English Governor of Massachusetts—described as an

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amateur strategist—who nominated a Devonshire man, William Pepperell, to organise and command a respectable, if undisciplined, force of some 4,000 local militia, who, together with a battalion of ships' marines, were to be conveyed in a fleet of 90 transports, escorted by a British squadron of four warships under Commodore Warren, and arrived in Gabarus Bay on 1st May, 1745. The land force being unprovided with qualified Engineers, Colonel Pepperell asked for the loan of an Engineer from Annapolis, and Mr. J. H. Bastide was sent and brought W. Cowley to assist him. These joined on June 5th and took charge of the siege operations. Some guns from the fleet supplied the artillery.

This quixotic expedition was favoured with wonderful luck and actually captured the fortress on June 17th after a six weeks' siege. This feat, described by Fortescue as "certainly one of the curiosities of military history, though forming no part of the history of the British Army," caused rejoicing in England, Pepperell being awarded a sum of money and a baronetcy. His force was taken on later as a part of the British army to form two regiments with Shirley and Pepperell as Colonels. The Colonial troops were then sent home and replaced at Louisbourg by some regulars from Gibraltar.

The two successful leaders, flushed with success, now saw a chance to complete the conquest of Canada, and actually received a promise from the Duke of Newcastle to dispatch adequate land and sea reinforcements to supplement a fine locally trained body of colonists, but, like many other of that nobleman's promises, it turned out to be a broken reed to rely on, and the expected help was diverted elsewhere. The opportunity was missed, and Great Britain had to wait another 13 years, at a cruel loss in blood and treasure, before she was to clear the French out of Canada.

However, by the Peace of Aix-la-Chapelle of August, 1748, Louisbourg was returned to the French "in exchange for an insignificant factory called Madras." !

As usual after a peace, popular clamour was for economy, and Great Britain reduced her military forces to an establishment of 30,000, of whom one-third was to be for the colonial garrisons. It was in that year (1748) that, fortunately for our country, there came into notice the man—William Pitt, later Earl of Chatham—

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who was to revive its waning prestige, and who was then a junior member of the effete Newcastle administration.

In 1749 the manhood of Nova Scotia received a stimulating influx of a large body of veterans of the sea and land forces who had been disbanded and were sent out with their families under liberal conditions. Out of these were formed valuable "Independent Companies of Rangers," who were available to reinforce the regular troops in Nova Scotia and Newfoundland, whilst Halifax with its splendid harbour—hitherto known by the name Chebucto—became a fortified port.

This naturally alarmed the French at Louisbourg who exerted themselves to build a chain of defences in the succeeding years, especially on the Great Lakes, which connected their base at Montreal with the Ohio.

In 1753 the Governor of Virginia took alarm at these encroachments and despatched the then Adjutant General of the Virginian Militia—no other than George Washington, then 21 years of age—as an envoy, to report on the situation and deliver a letter from Governor Dinwiddie to the French commander at Venango—a British trading station, but converted by the French into a military post—to request him to withdraw his troops from British ground. This request met with a none too polite refusal, the result being that the Virginian Assembly reluctantly voted a sadly inadequate sum for military precautions, but their pig-headed obstinacy and slowness to act led to such delays that the French only grew more persistent.

In 1754, however, an attempt—though only half-hearted—was made to deal with the situation; the Colonial militia was reinforced by two British regiments, the 44th and 48th, sent out from Cork, and some arms and cash, and the combined force was placed under the command of General Edward Braddock, to whose military capacity Fortescue alludes contemptuously, "though brave as a lion."

His orders were far-reaching and ambitious, as he was expected to drive the French from the Ohio—a task involving four separate parties, three being under subordinate commanders—Braddock was to attack Fort Duquesne; Shirley, Niagara; William Johnson, Crown Point; and Col. Monckton, Beau Séjour.

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Braddock, with 2,200 men including 100 R.A., had the advantage of Colonel George Washington as his Staff Officer, but notwithstanding that, he failed miserably, and owing to bad generalship, transport difficulties, ignorance of the country, Indian tactics and ambushes which were too much for him, a panic set in and a general *sauve qui peut* resulted on July 9th, with great slaughter. Both Braddock and Washington displayed great courage and the former died of his wounds. Fortescue's story of Braddock's disaster and personal heroism is eloquent and pathetic.

The detachment of R.A. with Braddock consisted, according to Duncan, of 50 men sent out from England under Capt.-Lt. R. Hind (81), two Lieutenants, three Fireworkers and one Cadet. On arrival, Capt. T. Ord was transferred from Newfoundland to take over command; there were 21 "civil attendants" of the train, "ten servants and six necessary women"—also five Engineers and practitioner Engineers. It was practically annihilated on 9th July, 1755, at Fort Duquesne (Monongahela). According to Kane I make out that the following R.A. officers took part in this disastrous affair:—

Capt. T. Ord (54)—survived; d. 1777.
Capt.-Lt. R. Hind (81) do. d. 1781.
do. R. Smith (101)—Killed.
do. W. Martin (109)—Prisoner. d. as Lt.-Genl. 1799.
2nd Lieut. F. I. Buchanan (132)—Wounded—d. Bt. Col. 1787.
do. John Macculloch (135) do. d. 1761.
do. Thomas Howdell (165) — d. 1761.
Fireworker David De la Cour (208)—Wounded—d. 1756.

There were four 12 prs. and six 6 prs., all brass, and all were lost. As regards Engineer officers there were five, under James Montresor who went ahead of Braddock's main body with 600 men to clear the forest road. When the latter came up on July 8th at Fort Duquesne it fell into an ambush next day of French and Indians, and four out of the five Engineer officers were wounded.

Monckton's force took Beau Séjour, a success which involved the expulsion of the French from Acadia. On the other hand an attack on Crown Fort by General Johnson failed, though he fought a gallant action which brought him recognition from the British Government. Shirley also failed against Fort Niagara. Added

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to these last set-backs came the horrors of treacherous massacres of our troops by Indians in Virginia, Maryland and Pennsylvania. George Washington, who had to guard a frontier of 300 miles with 1,500 militia, did what he could, but the supineness of the Pennsylvanian Assembly left him unsupported.

Thus we enter the year 1756. At home, the Newcastle ministry had been both helpless and obstructive and refused to augment the army. King George III had left for Hanover in May, 1755, leaving the reins of government in the hands of a Regency afraid of responsibility, and returned in September to hear of Braddock's defeat. Parliament met in November under stormy conditions, and Pitt vainly protested against the weak and vacillating policy of the Newcastle régime. A Militia Bill proposed by him was thrown out but ten new regiments had been added to the army.

In March, 1756, orders were given for the enlistment of foreigners in America, and as an invasion of England was feared Hessian troops were imported, in preference to the recruitment of British, for the defence of Great Britain.

In 1756 the French with a large force attacked Minorca which was weakly held, and captured it on June 28th after a desperate struggle, though at a loss to the victors of 2,000 men. The nation made a scapegoat of Admiral Byng, who was tried and shot on his quarter-deck. Fortescue says, "the unfortunate Admiral was shot because Newcastle deserved to be hanged" !

Meanwhile England was preparing for an invasion which never came off, and the small force in America was not reinforced except by two regiments in June. In July, Lord Loudon took over the command and found a shocking state of neglect and discipline prevailing.

In August 1756, Montcalm surprised the British port of Oswego and retired with 3,000 men on Ticonderoga. This year ended with unsatisfactory conditions for us in America, and Europe in the throes of the "Seven Years' War."

But, as mentioned earlier, an important political change was to be the salvation of Great Britain. In November, 1756, the egregious Newcastle had to make way for a very different stamp of man in the person of William Pitt who was now to be responsible for the honour of the country.

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When Parliament met on 2nd December, 1756, the King's Speech announced that the German troops (the presence of whom in England Pitt had always resented) were to be dispensed with, the Militia was to be strengthened, and the Army Estimates would allow for 30,000 men for Great Britain and 19,000 for the colonies. This included second battalions to 15 regiments, and the R.A. was to be brought up to 24 companies in two battalions. Some miners were raised, the Marines were augmented, and in fact there was a military revival.

Pitt became Secretary of War and Foreign Secretary in July, 1757.

To return to America, Lord Loudon had proved to be anything but an enterprising commander and after many reverses at the hands of the French found himself at New York in July, 1759, without orders.

Montcalm moved out from Ticonderoga with a considerable force in August against Fort William Henry which was under the command of Lt.-Col. Monro of the 35th Foot, and the garrison being weakened by an epidemic of small-pox was unable to withstand a vigorous siege and surrendered on August 9th. This reverse added to another suffered in Germany by Cumberland at the hands of the French, and the failure of a costly expedition against Rochefort, for which Pitt was responsible, filled the cup to overflowing and brought the disastrous year 1757 to a close, the only redeeming feature being the promotion, at the instance of Pitt, of the young James Wolfe to be Colonel over the heads of many older officers—a priceless boon to the Army as will shortly be seen.

Mante in his history relates how thoroughly disgusted and discouraged the British nation was at the sequence of unsuccessful and ruinous enterprises in America and elsewhere, some of which we have already alluded to, and William Pitt, now virtually at the head of the Government, was determined, so far as he could, to stem the tide of disaster. He therefore directed his attention to British North America where it had become imperative to check the French conquests, and accordingly fixed upon Louisbourg as the objective of an expedition. As commander of the land force he selected Jeffrey Amherst, then a Colonel serving in Germany, whom he recommended to the King for promotion to Major

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General. Admiral the Hon. E. Boscawen was given command of the fleet which was to escort the transports conveying the troops, the rendez-vous being Halifax, and was to act as Commander-in-Chief of the expedition pending the arrival of General Amherst.

PART II.

LOUISBOURG—1758.

Before describing the siege and capture of this important French stronghold it may not be out of place to give a very brief biographical sketch of the *dramatis personæ* most directly concerned in the inception and carrying through of the operations, viz. William Pitt, Major-General Amherst, Brigadier Wolfe, Lt.-Colonel Williamson, Admiral Boscawen and William Amherst.

1. *William Pitt*, born 1708, entered parliament 1735 during the Pelham and Newcastle administrations; was Paymaster-General 1746-7, Secretary at War and Foreign Secretary July 1757; resigned office October 1761. Created Earl of Chatham 1766. Died 11th May 1778 as the result of a seizure in the House of Lords after delivering an excited speech. Dr. Johnson, alluding to two great Ministers, said "Walpole was a Minister given by the King to the people, but Pitt was a Minister given by the people to the King." What endeared him to the people was his "spirited foreign policy."

2. *Jeffrey Amherst*, 1717-97. Ensign in Guards 1731; served in Germany and Low Countries and was with Cumberland in the wars of the Austrian Succession in 1757; was Lt.-Col. 1756 and specially promoted Major-General in 1758 to command the Louisbourg expeditionary land force. Served with success at Louisbourg, Ticonderoga and Crown Point in 1758; capture of Montreal 1760; Colonel of 60th Regiment 1763; and was Governor General of British North America. Created a Peer 1776 and made Field-Marshal 1790.

3. *Brigadier James Wolfe* 1727-1759—son of a Lt.-General in Marlborough's army. Commissioned in the 12th Foot in 1741. Fought at Dettingen in the year 1743 and was promoted Lt. for distinguished conduct. Capt. K.O. (4th Foot) in 1744. Bde. Major at Falkirk and Culloden 1745. Major 1747. Lt.-Col. 20th Foot 1750; Staff Officer in the unsuccessful expedition to Rochefort

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(France) 1757. Col. 1757. Brigadier at Louisbourg 1758. Major-General in command of expedition against Quebec, and died gloriously on 13th September 1759 in the hour of victory.

4. *Lt.-Col. George Williamson*, R.A. (31). Cadet Mattross 1722; Fireworker 1725; Lt.-Col. 1757; in command of R.A. at Siege of Louisbourg 1758. Took on his three companies after being reinforced in June 1759, to join Wolfe's army then assembled on board transports in Louisbourg roads; did good service at the Isle of Orleans, was left at Point Levi and, in 1760, joined Genl. Amherst's expedition up the St. Lawrence, being conveyed in row-galleys. Williamson volunteered in August to lead an attack on the French brig *Ottawa*, which he captured after a 2½ hours' action. General Amherst changed the name of the prize to *Williamson*. The expedition after capturing Fort Levis in the Isle Royale took Montreal, after two days' siege, which ended the French occupancy of Canada. Williamson was made Col. Commandant of the 3rd Battalion Nov. 1759; Major-General 1762. Lt.-General 1772. Commandant at Woolwich 1765, and died there 11th November, 1781.

5. *Admiral Hon. E. Boscawen* 1711-1761. Had a distinguished naval career. Was a Vice-Admiral 1755, and thrice defeated and took prisoner the French Admiral Bocquart in successful sea-actions. He was chosen by Pitt as Naval Commander-in-Chief of the expedition to Louisbourg and shared with General Amherst in the glory of the capture of that fortress and destruction of French fleet in July, 1758.

6. *William Amherst*. 1732-81. Youngest of four distinguished brothers. Ensign 1 Foot Guards 1755; Lt. & Capt. 1757; local Lt.-Col and D.A.G. in America 1759; Lt.-Col. 1765; Col. 32nd Regt. 1775. Major-Genl. 1777; Lt.-Genl. 1779. In 1762 he commanded a small force sent from New York against the French under M. Le Compte D'Haussonville, who had captured St. John's, Newfoundland. Amherst successfully forced them to surrender as prisoners of war. The Artillery with the expedition consisted of 58 men under Capt.-Lt. Andrew Ferguson (155), with 28 pieces of ordnance. In default of heir male to his brother Jeffrey, Lord Amherst, William's son succeeded to the Peerage.[1]

[1] See "The Recapture of St. John's, Newfoundland, in 1762" &c. Edited by John Clarence Webster.

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We must now proceed to the second and final Siege of Louisbourg. Mante—a Staff officer in N. America—in his valuable "History of the late War in America"—1772, gives a daily journal of the siege, with an excellent map. This work is undoubtedly the basis of most of the histories of this campaign, and agrees with the recently discovered "Journal of William Amherst (brother of the General) in America, 1758-60," and published by a Canadian gentleman, Dr. T. C. Webster—July 1927. Smollett's History of England, Vol. XII; Duncan's History of R.A., Vol. I; Porter's History of R.E., Vol. I; and last, but not least, Fortescue's History of the British Army, Vol. II, all serve to place the student of Military History *au fait* as to this interesting campaign.[1]

As mentioned in Part I, Admiral Boscawen, the selected Naval Commander-in-Chief, sailed from England with an imposing fleet of some 157 war and other vessels on 18th January 1758, conveying an army of 12,000 men, including 324 R.A. under Lt.-Col. G. Williamson; 14 infantry battalions and 11 Officers of Miners and Engineers under Lt.-Col. Bastide and Major Mackellar, who were to direct the siege operations, assisted by selected infantry officers. The Ordnance consisted of 87 guns, 75 mortars and 6 howitzers of various calibres and 90,000 rounds of ammunition for them.

The Fleet arrived safely at Halifax in time to sail for Louisbourg on 28th May and as it moved out of the harbour it was joined by H.M.S. *Dublin* with Major-General Amherst, the military Commander-in-Chief, who at once transhipped into the Admiral's Flag Ship *Namur* and took over command of the troops.

The expedition came to an anchor in Gabarus Bay—some seven miles west of Louisbourg—on 2nd June, 1758. The French garrison consisted of 12,500, and 600 Canadians and 60 Indians, commanded by the Chevalier Drucour; the harbour was occupied by 11 war ships of which three were sunk across the entrance to obstruct it. The fortifications of the town were in bad order, but the coast line was well entrenched and guns mounted in batteries.[2]

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[1] Dr. Clarence Webster has published an elaborate paper, "The Rise and Fall of Louisbourg" in the "Annual Report of the Canadian Historical Association" May 17 & 18, 1926.

[2] See Map I.

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Of the British fleet the second in command, Admiral Sir C. Hardy flew his flag on the *Royal William.* The three Brigadiers of Amherst's force were Colonels Whitmore, Lawrence and Wolfe. There were three possible landing places of which Freshwater Cove was destined for the true attack under Wolfe, and White Point and Flat Point for two simultaneous feint attacks by Whitmore's and Lawrence's commands. These feints were to divert and distribute the enemy's force.

After a delay of nearly a week, due to the weather, the boats of the landing parties made for the shore on June 8th, through a dangerous surf. The fleet maintained a heavy fire to cover the advance of the boats. The enemy's resistance happened to be strongest at Freshwater Cove, and Wolfe's party, which included the Light Infantry and Grenadiers—the pick of the Infantry—had its work cut out; boats were stove in by the surf, but the men were not to be denied, and, led by their gallant chief, by sheer pluck forced their way on shore only to be met by a deadly fire of musketry and grape from cleverly concealed batteries. But "nothing could restrain their ardour." Major Scott commanding the Light Infantry was the first to land; the attack was pushed home and the enemy retreated, leaving four officers, 70 men and 24 guns in the hands of the British, who lost three officers and 43 men killed, and five officers and 55 wounded.

Lawrence supported Wolfe and landed at the western end of the beach, taking the enemy in flank. General Amherst followed and encamped out of range of the fortress guns. The rest of the force were now able to land, and occupied the evacuated outpost works. The town and fortress were then systematically invested, the British troops erecting traverses to protect them from the fire of the French warships and of such of the Canadians and others who were still outside the works.

Meanwhile the siege material and stores had to be landed, and this was effected by the R.A., aided by a Marine battalion under Captain Collins, at Flat Point, east of Kensington Cove. A party of infantry also assisted.

There was a fine work, the Grand Battery, on the north shore of the harbour commanding the entrance, but the enemy destroyed this when the British had landed.

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The French commander now took measures to withstand a regular siege, destroying outlying defences, calling in outposts, and maintaining a brisk fire on the invaders of their lodgments.

On *July 9th* they made a determined sally by 600 men against General Lawrence, surprising Capt. Lord Dundonald's Grenadiers, in which that gallant officer lost his life, and Capt. Bontein of the Engineers was taken prisoner. A truce was arranged to bury the dead. The enemy continued very obstinate on the *10th and 12th.* On the latter day Wolfe was detached with some 1,200 men to make a flanking and encircling movement right round the N.E. part of the harbour, and he occupied the abandoned posts, pitching his camp just north of the dismantled Grand Battery. His troops continued round and occupied the points up to Lighthouse Battery. The Artillery had been sent by sea.

On *July 19th* various batteries were armed to command the ships in the harbour, and the Island Fort was silenced.

On *July 20th* the siege was in full vigour and batteries were in play against the fortress and ships from both sides. Wolfe is described as displaying "amazing activity." Meanwhile the British Navy had captured the French warship *L'Echo*, which with others had slipped out of the harbour, and the Admiral took measures to deal with the only two remaining French men-of-war, the *Prudent* and *Bienfaisant*, the Artillery fire having, on the *21st*, accounted for the three in the harbour, which blew up. Accordingly two divisions of boats under two young Captains, Laforey and Balfour, entered the harbour in the dusk, boarded the *Prudent* which was aground, and set her on fire, and towed out the *Bienfaisant* under British colours. This happened on the *25th*.

To go back to the *22nd*, our two batteries of 13-24 prs. and one of 7 mortars respectively had opened on the fortress, setting fire to the Citadel. Col. Williamson gave special orders to these and to a new battery of 4-24 prs. to spare the town as far as possible. The Barracks soon took fire and the end was not far off.

The perfect co-operation between the two Commanders-in-Chief was bound to ensure success, and the help given on shore by the navy was invaluable.

The state of affairs in the doomed fortress and town was now such that the gallant French commander, M. Drucour, was forced

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to yield to the pressure put on him by the inhabitants, and surrendered unconditionally on *July 27th.*

By the terms of the Capitulation (given in full in Mante) the town of Louisbourg and island of Cape Breton were annexed to Great Britain. The garrison—some 5,700—were embarked for England as prisoners of war, and a vast quantity of ordnance, arms and stores were taken over. The inhabitants and merchants were given free passage to France.

This complete victory was greatly applauded in England, and Capt. W. Amherst, 15th Foot, brother of the General, was sent home in H.M.S. *Shannon* with the despatches and trophies. Eleven pairs of captured colours were taken to St. Paul's with great pomp and deposited there. Capt. Amherst in his interesting diary describes how Mr. Pitt embraced him, saying "This is the greatest news." The King rewarded him with £500 and £100 for a sword or ring. General Amherst was made Commander-in-Chief in North America and his brother D.A. General there. The latter returned to Boston on 2nd December 1758.

The rejoicings throughout the country were universal, and the defeat and loss of ships was severely felt in France.

The British loss in the expedition was 21 officers and N.C.O's and 146 men killed, and 31 officers and N.C.O's and 318 men wounded.

The Admiral in his dispatch drew special attention to the gallantry of Captains Laforey and Balfour in the boat attack above noted.

As regards the Artillery, their losses were light. Duncan mentions that Lt.-Col. Williamson's arrangements for the bombardment received full approval by the Commander-in-Chief. The siege operations were directed by Major Mackellar as Engineer, Col. Bastide having been wounded early in the day. Duncan quotes a French officer who was through the siege which goes to prove the great accuracy of the Artillery fire and ruin caused by it.

An amusing story is told of an ingenious *ruse* by the Governor of the fortress, who in the interests of humanity begged that fire might not be directed at a particular part of the works behind which was a hospital. "As however, there were shrewd reasons for believing that not the hospital but a magazine was the subject of

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his anxious thought" his request was refused, but he was given the option to remove the sick and wounded on board a ship, or onto an island, under British sentries where they would be safe. The offer was not availed of.

On the signing of the articles of Capitulation on July 27th the British took possession, the garrison was disarmed, and some of the fleet entered the harbour. A company of Miners 100 strong under Major David Muckell, R.A.[1] (168) assisted by parties of infantry working six days a week, was detailed for the demolition of the fortifications which was not completed till November 1760.

Praise has been accorded to the French for their defence. M. Drucour did all he could to delay the inevitable, hoping to give time to Montcalm to get into touch with the enemy. The defences were badly found and without overhead cover, but his troops fought gallantly and well.

In the Boat action to cut out the *Bienfaisant* there took part a petty officer called Cook who was to be, later on, the famous navigator, Capt. Cook.[2]

After Louisbourg it fell to Wolfe to have the unpleasant duty of expelling the French inhabitants from Acadia, etc. and he then returned to Halifax to winter, and being far from well, went on sick leave to England.

Meanwhile Amherst had gone to Boston to help Abercrombie, who was in a bad way, and this seriously delayed his coming to reinforce Wolfe's small force which consisted of only 8500, whilst Montcalm was known to have 12,000 strongly entrenched.

Wolfe returned in the spring of 1759 to Louisbourg with a fleet of 21 ships under Admiral Saunders in readiness for the expedition to the St. Lawrence, sailed on 6th June and was safely anchored three weeks later off the Island of Orleans, a feat of seamanship and navigation which surprised the French. After several ineffective attempts against the French position on the north side of Quebec, skilfully countered by Montcalm, it was not till 12th September 1759 that a clever inspiration led to a complete change of Wolfe's plans, viz. a secret landing in boats on that night by 500 men on

[1] Killed in 1761 at the Siege of Belleisle.

[2] Bicentenary of birth celebrated in England 8 Sept. 1928.

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a small beach under a high cliff about 1½ miles above Quebec. (See Map 2.) This force debouched unopposed by a narrow path on to the heights known as the Plains of Abraham, and was followed by the rest of Wolfe's army which formed up at daybreak. The Fleet had done good service in distracting the enemy by a false attack on their camp at Beauport.

The subsequent fight and glorious victory, on the 13th September, resulting in the deaths of the two rival and heroic commanders is so well known that it need not be further alluded to here.

Owing to Wolfe's sudden change of plans the R.A. was only represented by 50 men with one gun under command of Capt.-Lt. John Yorke[1] (154). They did well and the solitary gun is stated to have been a thorn in the side of Montcalm and led him more than once to a change of plans! The R.A. had the honour of hoisting the British colours on Quebec.

A very few lines will now suffice to complete our story. We left William Amherst in England, received with congratulations, and he lost no time in returning to rejoin his brother whom he met on November 19th at Halifax and accompanied to New York, where they got the news that Fort Duquesne[2] had been abandoned by the French and was occupied by a British garrison.

On 21st June 1759 Amherst's army 12,000 strong was on Lake George, and a month later Fort Ticonderoga fell and was blown up by the enemy. The General's brother again left England with despatches, got back to New York on 22nd March 1760, and rejoined General Amherst at Oswego on 16th July. He mentions that Col. Williamson R.A. was there.[3]

Amherst's command comprised three separate bodies all with Montreal as their objective, viz: the main body at Oswego, and two smaller columns under Brigadier Murray at Quebec and Col. Haviland at Crown Point. All had to traverse a strange and difficult country obstructed by the enemy, but all arrived at their goal within 48 hours—truly a notable feat.[3]

[1] Yorke died in 1767 as a Colonel of Portuguese Artillery.

[2] The scene of Braddock's disaster.

[3] William Amherst's diary.

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The defenders of Montreal, enclosed on all sides, had no choice but to surrender unconditionally. In the words of William Amherst's diary:—"Mons. Vaudreuil, Governor General of Canada, surrendered to the British Crown more than ever was given to any Crown before."

Thus what Amherst began at Louisbourg and Wolfe continued at Quebec, Amherst completed at Montreal.

MAP No. I.[1]

Part of the Island of Cape Breton.

This map is given in Mante's "History of the War in North America" published 1772. It is undoubtedly taken from the contemporary survey by Capt.-Lieut. Samuel Holland, Royal American Regiment (60th), Engineer to Brigadier James Wolfe, on which are depicted the 5 ships sunk by the French to block the entrance to the harbour shown here by the line X—Y (added by the writer on the photo). Five French war ships are also shown as being moored in a line parallel to, and some 500 yards to the west of, X—Y. These were bombarded by Wolfe's batteries on shore to the east, at an average range of 1600 yards which drove them into the west corner of the harbour, where they were accounted for by the Navy (see letter press).

MAP No. II.[1]

Canada and the N. American Colonies.

1680—1760.

From Fortescue's History of the British Army, Vol. II. (Part only of this map has been reproduced). This map shows the greater number of the forts etc. named in the text. It does not go so far south as Georgia, but includes the inset of the siege of Quebec, which is briefly touched on at the end of the text.

[1] The reproductions are by W. Davey & Sons, Harrogate.

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PART of the ISLAND of CAPE BRETON
Scale of Feet
1000 2000 3000 4000 5000 6000
Road the Troops marched when the Enemy retreated
Fresh Water Cove
ROCKS
Flat Point
Artillery
Redoubt
Redoubt
Redoubt
Redoubt
Redoubt
Redoubt
Redoubt
Redoubt
Redoubt
Light Infantry
Evening Guns
Barracks
Redoubt
Redoubt
Redoubt
Redoubt
Redoubt
Redoubt
Grand Battery Dismantled
NORTH EAST HARBOUR
HARBOUR
West Gate
Battery de la Grave
LOUISBOURG
Battery
Rochford Point
Cape Noir
White Point
Breach Rock
Goat Island and Battery
Light House
Light House
HARBOUR'S MOUTH
Port of Green Island
References
to the Place of Landing the Troops and the French Batteries & Entrenchments.
A. Where the Light Infantry Landed
B. Where the rest of the Troops Landed when the Enemy retreated
C. One Swivel
D. Two Swivels
E. Two Six Pounders
F. One Twenty two Pounder and two Six Ditto
G. One Mortar of Seven Inches and one of Eight Do
H. Two Swivels
I. Two Six Pounders
K. Two Swivels
L. Where the heavy Artillery and Stores where Landed
M. Where Provisions &c. where Landed
N. Two twelve Pounders
O. Two Six Pounders
P. Two Twenty Four Pounders
Q. Two Six Pounders
R. Two twelve Pounders
S. Towers of Timber Framed at Halifax by the English
Reads
X-Y Five Sunken Ships

Map II,
CANADA,
AND THE
NORTH AMERICAN COLONIES.
1680 - 1760.
ENGLISH MILES
0 50 100 200 300 400 500
CANADA
R. St Lawrence
Gulf of St Lawrence
Newfoundland
St Johns
Prince Edward Is
C Breton Is
Louisburg
Canseau
Nova Scotia
Bay of Fundy
Port Royal
Halifax
Quebec
Pt Levis
L. Nipissing
(Ottawa)
L. Simcoe
Ft Frontenac
Lake Ontario
Ft Oswego
Ft Niagara
Falls of Niagara
IROQUOIS
THE FIVE NATIONS
Lake Erie
Ft Presque Isle
Ft Venango
Logstown
PENNSYLVANIA
Fort Duquesne
(Pittsburgh)
Loyalhanna
Carlisle
Ft Cumberland
MARYLAND
DELAWARE
NEW JERSEY
NEW YORK
Albany
NEW HAMPSHIRE
MASSACHUSETTS
Boston
CONNECTICUT
RHODE ISLAND
Long Island
New York
VIRGINIA
Allegheny Mountains
NORTH CAROLINA
SOUTH CAROLINA
Hospital
River St Charles
QUEBEC
River St Lawrence
THE SIEGE OF QUEBEC,
The Battle of Sep 13th 1759
British
French

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AEROPLANE CLOCK CODE v. OBSERVATION.

BY "SAGITTARIUS."

1. In an article in the July 1928 number of the Journal of the Royal Artillery, on Forward Observation, Major R. S. Ellis sums up as follows:—

> When the F.O.O. has a telephone he should control the fire and when only visual is possible he should use clock code giving observations only. The balance appeared to be in favour of the F.O.O. giving observations by clock code, as against directing the fire himself, using artillery code.

2. One of the most important duties of a gunner officer is undoubtedly the power of reaching effective fire on a target in shortest time, with the minimum expenditure of ammunition, and with due regard to the tactical situation, and type of target. This is a matter which requires constant practice both at the miniature range and with live shell. The clock code method was brought in to enable officers of other arms to observe artillery fire when no artillery officer was available. The clock code is the method for an untrained observer to use; not because it is the best method, but because infantry officers owing to lack of practice could not be expected to use any other. It seems deplorable that artillery officers should own frankly that they are unable to perform one of their most important duties. This appears the only reason for adopting the clock code as normal.

The adoption of the clock code would undoubtedly for this reason lead to a lower standard of training. If a young officer once gets it into his head that he need not learn how to shoot a battery, because he can always delegate the responsibility to someone else, one can hardly blame him if he regards the knowledge of shooting as being of minor importance. I think that no one will argue seriously that the above frame of mind is desirable in an artillery officer; nor will they fail to agree that any procedure which might produce this outlook is to be deprecated.

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3. The essentials for any successful shoot are :—

(a) That effective fire should be reached in the least possible numbers of rounds, in the shortest possible time, and with the most effective projectile for the target in question.

(b) That our own troops should be safe during ranging and fire for effect.

To this may be added that the process of ranging should continue during fire for effect.

4. Major Ellis in his article rather visualised the normal F.O.O's target as a fleeting opportunity. This I do not agree with. The normal target that an F.O.O. will be asked to engage will, I feel sure, be either

(a) A located machine gun;

(b) A machine gun area;

(c) A strong point or other form of defensive work.

Of the above, probably (b) will be the most common. On occasions the G.F. target will present itself, but the chance of hitting a sudden counter attack using any form of visual communication is, I think, doubtful in the extreme.

We see that two factors arise in studying the question of the best engagement of targets (a), (b) and (c).

(i) The infantry will probably not ask the F.O.O. for help until they have found the target. When I say found the target, this really means that they have been stopped by fire from it, and are unable to get on under the fire of their own weapons.

(ii) When infantry are held up by a target of this type, the first thing they will do is to try and work round one or both flanks.

We therefore arrive at the fact that the normal F.O.O's target will not only be an accuracy target, but will also be a "proximity" shoot not only for range, but also for line in the majority of cases. The infantry will undoubtedly take advantage during ranging of any round which happens either to be near the target, or which gives any screening effect, to creep in closer. So we may assume not only that the proximity element will be present in most shoots, but also that the degree and direction of this element will be changing.

5. Now let us study the pros and cons of clock code v. direct observation.

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It is argued that clock code is quicker, partly because the messages are shorter. Remember we are not going for speed to first round, but speed to effect, and the correct engagement with the right projectile. Possibly using clock code the first round may go off quicker than when using the artillery code, but as to getting quicker to effect I doubt it. Aeroplane ranging depends to a certain extent on judging how far a round is plus or minus. With an air observer in the air with perfect command, we are taught to regard his observation as an indication only, thereby implying that he cannot judge accurately. If with perfect command he is liable to error; *a fortiori* the F.O.O. with little command is liable to make very large mistakes in judging distances. Again it definitely lays down in the book, that a distorted clock must be used, so that until several rounds have given an indication, the range and line cannot be altered simultaneously. This cuts out the use of the most valuable O.T. rounds.

If the F.O.O. has good command his observations are likely to be more accurate, but on the other hand with command, normal control becomes easy. One of the most important things in learning how to shoot a battery, is the correct use of the ground round the target. This is wasted in clock code shooting. The officer who can see the target is the best judge of the correct method of engagement, yet when using the clock code he deliberately gives up this great advantage, and hands the conduct of the shoot over to someone who cannot see.

6. Much stress has been laid on the fact that clock code messages are shorter than those necessitated by the artillery code. Major Ellis' article envisages, quite rightly, that the F.O.O. will frequently be required to communicate by visual. If visual communication is through, it takes very little more time to send fire orders by the artillery code than observations by the clock code, especially if a high standard of encoding and decoding has been reached by the battery personnel. With mountain batteries on the N.W. Frontier of India, the artillery code is the normal method of communication. No one who has seen these batteries at work with the code can fail to be struck by the speed which can be attained by this method. This leads one to suppose that the standard of speed normally reached by batteries could be considerably improved

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with constant practice. One of the present disadvantages of the artillery code, encoding and decoding, under war conditions, will possibly disappear with the introduction of easily memorised abbreviations.

7. Half of the ammunition of 18 pr. batteries is at present shrapnel. In using the clock code the B.C. if he wishes can range with shrapnel, but when going to fire for effect he should use a corrector. The clock code makes no allowance for information regarding height of burst; any information the F.O.O. sends about height of burst, will have to be in artillery code or in clear. In this respect, A.T. Vol. II, 1928, sec. 58, 2 (e) implies that when direct measurement cannot be made (i.e. the normal case for the F.O.O.), the best method of observing height of burst is by the pattern the bullets make on the ground. How can the F.O.O. give the B.C. this information, except by taking charge himself? It must be remembered that, if an F.O.O. starts a shoot using the clock code, and wishes at any time to change to direct control, he must get certain information as to range and line from the B.C. It must be remembered that in the case of proximity shoots where the infantry have perhaps worked round one or both flanks, time shrapnel will be the only projectile that can be safely used for fire for effect.

8. The final and perhaps decisive argument against the normal employment of clock code is the question of the safety of our own troops. The adoption by the artillery of any method of fire control which endangers our troops is impossible. Yet it is suggested that, because visual communication only is available, we should give clock code observations.

The essence of proximity shooting is that no round should fall among our own troops. This is legislated for by creeping, either for range or line. The essence of clock code shooting is bracketing, both for line and elevation. Without bracketing, and bold bracketing at that, it will in most cases take a very large amount of time and ammunition to get to effective fire.

How then is the safety of one's own troops to be assured in the position they are in at the commencement of the shoot? If they move their position during the shoot as they may well do, how is this further information to be sent to B.C. The only way that

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I can see is a message in clear or some form of code. Even if this information is sent back to the battery how is the officer to bracket, or if he does not bracket, is there any indication of how much he can creep. If messages of this type have to be sent during or before a shoot, the last argument in favour of clock code, i.e. the shortness of messages, falls to the ground. I can imagine no more tedious or wasteful proceeding than a clock code shoot taken on by creeping methods, the observations to the battery being interlarded with messages about the position of our infantry; and during fire for effect, if that is ever reached, by messages about the height of burst. I feel that under these circumstances the infantry would not be very pleased with the support afforded by their guns.

On the other hand, take the case of a capable officer observing in the ordinary way. He can see the ground round the target and the position of our own troops, and can make his plan accordingly. He can obey the rules for proximity shooting, make use of O.T. rounds, and at fire for effect can use the correct ammunition, and continue his ranging during fire for effect.

Referring again to what is probably the normal target for an F.O.O., i.e. machine guns located approximately only, it will be necessary for some searching to be carried out at fire for effect. This searching may be necessary, either laterally or in depth, and in order to avoid gross waste of ammunition it is essential that this searching should be directed by an officer who can see the area in question. How is this to be done, when using the clock code?

In conclusion, while it is obviously necessary for an untrained observer, either belonging to the artillery or other arms to use the clock code, this should definitely be regarded as an emergency method. With an efficient observer (and this standard of efficiency is well within reach of any artillery officer of over a year's service if he has been correctly trained) the normal method should be direct control, whatever means of communication are available. Direct control, using the artillery code, with an efficient observer, for the reasons stated in this article, will produce effective fire with a smaller expenditure of time and ammunition, and, at less cost to the infantry, than the clock code can possibly do.

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THE PROBLEM OF FLANK OBSERVATION.

Being an article by Oberleutnant Gallwitz in the *Artilleristiche Rundschau*, June, 1928.

Foreword by the translator.

In this translation, an effort has been made as far as possible to avoid altering the original article. Where the German notation for battery, target, and observation post has been used, however, it has been changed into the B.T.O. more easily understood by our Army. It would have been equally easy to substitute degrees and minutes for the "Teilstriche" used in the German Army, but it was felt that this was unnecessary, since the conversion can easily be made by anyone, and the unit used does not affect the principle of the systems described.

For the benefit of those readers to whom the "Teilstrich" (which has been translated throughout as "Graduation") is unfamiliar it is to be noted that it equals 1/16 of a degree. Thus the circle is divided into 5760 graduations, and 180 degrees equals 2880 graduations, and so on. It has the advantage that

at 1000 metres, 1·1 metre subtends one graduation,

at 2000 metres, 2·2 metres subtend one graduation, and so on.

Further, if at a range R metres a target subtends n graduations at the eye, then it is approximately true to say that the extent of the target is $\frac{R}{1000} \times n$ metres. Thus if at 6000 metres a target subtends 100 graduations, then its extent is $6 \times 100 = 600$ metres. Some of the systems described in the earlier part of the article do not present any very novel ideas, but have been included to avoid breaking the thread of the author's argument. Should any officer be appalled by the mathematical notation of the proofs of these systems as set out, he is advised to skip the first few pages and start with the system described by Fig 3, which makes few

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demands on any mathematical knowledge. The last two systems are very simple, practical and interesting, and it is to be hoped that they will be tried out by someone. If they are likely to fail, it seems that they will do so in hilly country, against targets situated on crests of no great depth. Since both systems depend on the assumption that the M.P.I. of a group of shell fired at an elevation of, say, 5400, will fall 400 yards further than the M.P.I. of a group fired at 5000, it is possible that the longer carry of a group falling on the reverse slope of the hill may throw the system out of gear.

In the system proposed by Lieutenant de Lombares, however, the plan is drawn for each target engaged, and provided the slope of the ground is fairly uniform, the system will apparently provide a solution, even though the actual fall of the shell may be false when compared with the map range.

In the wholly graphical solution proposed by the author, an error in the first application of the ruler is not of great importance, since the procedure can be repeated several times until the alteration of the elevation between the two ranging groups is so small as to make the elimination of error almost certain.

The translator wishes to acknowledge the kind permission of the author and the periodical concerned to republish the article.

The author commences by stating that there are so-called insoluble problems in many spheres, such as that of splitting the atom, and squaring the circle and so on. He states that these problems are not insoluble if we possess the necessary tools, for example, we could split the atom if we could apply the necessary energy, while the so-called insolubility of the various mathematical problems only originates from the fact that our predecessors restricted themselves to compasses and rulers as instruments. By such means the solution is in reality impossible, just as if one only allowed sulphuric acid and caustic potash to a chemical expert for an analysis, or aspirin and castor oil to a doctor for a treatment. "If on the other hand one allows a table of logarithms for example, then any ordinary schoolboy could solve these problems without more ado."

He then states that our Artillery problem is flank observation, and that this has not been really solved, because all proposed

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methods of defeating this problem have been rejected because of their reliance on some "gadget" or other. He replies to this that without some extra help the problem can be mathematically proved insoluble, since it presents three unknown quantities, and only two equations for their solution.

The solution of the problem, then, by unassisted means, can only occur by chance, and cannot be carried out systematically.

This leads him to the conclusion that we require some gadget or other, but that it should be as simple as possible. He then proceeds.

"Let it first be granted that the procedure laid down in the Manual is without doubt the simplest, and makes the fewest demands on the skill of the B.C., but it is nevertheless by no means ideal. It substitutes for the third equation required, the assumption that the target presents a certain width, and the B.C. must already know the approximate switch. The shoot is then conducted on a kind of trial and error principle. Let us, however, assume that perhaps a periscope pops up in the middle of a wood, or that in a shell hole in the middle of a flat plain is a well-hidden machine gun, or a well dug-in trench mortar indicated only by a single picket, or an O.P. betrayed only by its stereoscopic glasses, then I am sure that at the end of the shoot—always provided that the target has kindly stayed there so long—the brigade commander would be shouting very loudly for his ammunition column.

Now certainly the above examples are exceptionally unfavourable, in normal cases the procedure in the Manual would doubtless also well and efficiently lead one to the goal, but that does not relieve us of the duty to master also some procedure for use in a more difficult case.

Since the procedure suggested by me saw the light (in *Artilleristiche Monatshefte*, 1925, Nos. 219/20 and 223/24) a whole series of articles on this question have appeared. A brief glance over these will now be taken so that we can choose from the varied programme a procedure suited to our taste. Significantly enough, a great number of them are from the *Revue d'Artillerie*, an indication of what universal importance this problem has.

About three years ago two methods were set out there, of which the first was by Sous-Lieutenant Bataille. Fig. 1.

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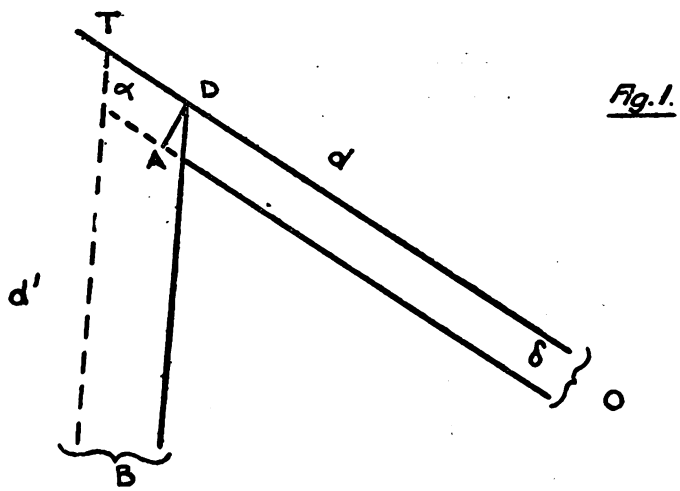

Fig. 1.

He first gets a round which can be observed.

If B is the battery, T the target, and O the O.P., then let α=BTO the apex angle, d'=BT, and d=OT.

If α is under 300 graduations (18 degs. 45 mins.) the line must be altered by a correction equal to the observed deviation multiplied by the factor d/d'. This complicated sentence merely means that one shoots as if one was in the line BT.

If α is more than 300 graduations then one alters the elevation through a distance $h_1 = \frac{d}{100 \sin \alpha}\delta$, where δ is the observed deviation in graduations.

The proof (about which the *Revue d'Artillerie* is silent) is simple. If the first shell fell at A, AD is measurable in graduations and its real magnitude is $\frac{d}{1000}\delta$.

Now α=BTO=BDO=DCA

therefore $\sin \alpha$=AD/CD

therefore CD=AD/$\sin \alpha = \frac{d}{1000 \sin \alpha}\delta$.

In this it is assumed that D is near T, so that TB and DB and OD and OA can be taken as parallel, and OD as equal to OT. The ranging rule runs

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Alter the deflection by δ_1 (5, 10, 15, etc., graduations) and at the same time alter the elevation by $h_2 = \frac{d'}{1000 \tan \alpha} \delta_1$.

The proof of this is also easy. Fig. 2.

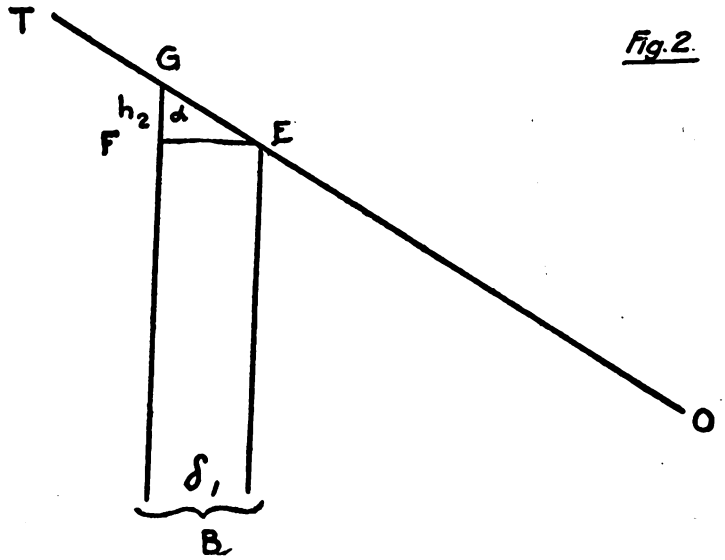

Fig. 2.

A simple deflection correction of δ' would move the shell from E to F, where $EF = \frac{d'}{1000} \delta_1$ the angle BGO will then be nearly equal to $BTO = \alpha$, so $\tan \alpha = EF/FG$, from which $h_2 = FG = \frac{1000 \tan \alpha}{d'} \delta_1$.

If we prepare tables for the factors $\frac{d}{1000 \sin \alpha}$ and $\frac{d'}{1000 \tan \alpha}$ we can easily read off the next order.

The second system, proposed by Lieutenant Chanzy, is similar. He first fires two rounds at the target with elevations differing by 100 metres, and measures the angle δ subtended by this distance at O. If apex angle α, and d the length OT, are known this angle δ can be calculated without shooting. For example, if in Fig. 1 we mark off from T along TB, TH equal to 100 metres, then in the triangle OTH the angle $OTH = \alpha$, the side $OT = d$, and $TH = 100$ metres, so the angle HOT which is δ is easily calculated, the resulting values can be reduced to a table which can be shown in a shortened form, thus:—

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TABLE I.

δ from α and d.

		α in Graduations.			
		100	300	600	800
"d" in metres.	1000	9	25	57	70
	2000	4	14	25	35
	3000	3	9	18	22
	4000	2	7	14	18

Example. The apex angle $\alpha = 600$ graduations.
Distance OT $d = 2000$ metres.

Then 100 metres along BT in the neighbourhood of T will subtend 25 graduations at O. If now a shell falls near the target but 50 graduations from OT we must add or drop 2×100 metres to obtain a round on OT.

While Bataille alters the deflection and calculates the appropriate change in elevation, Chanzy does the opposite. He calculates the deflection which is necessary to keep the shell on OT for an alteration in elevation of 100 metres. If in Fig. 2 FG = 100 metres, then EF = 100 tan α, so $\delta_1 = \frac{100 \tan \alpha \times 1000}{d'}$ approximately (answer in graduations). For this also a portion of the table is given.

TABLE II.

δ_1 from α and d'.

		Apex angle α in Graduations.			
		200	300	600	800
"d" in metres.	2000	9	14	31	48
	3000	6	10	21	31
	4000	5	7	16	24

If one is shooting therefore at 3000 metres and $\alpha = 200$ graduations, one generally adds 400 metres and simultaneously orders $4 \times 6 = 24$ graduations more (i.e. left) then drop 200 metres and 12 graduations less (i.e. right) and so on.

The two methods are worthy of notice. They can be used as well in the difficult cases previously mentioned. Their weakness lies in the fact that the approximations made in the calculations together with the zone of the gun, may easily throw the shell off the line O.T."

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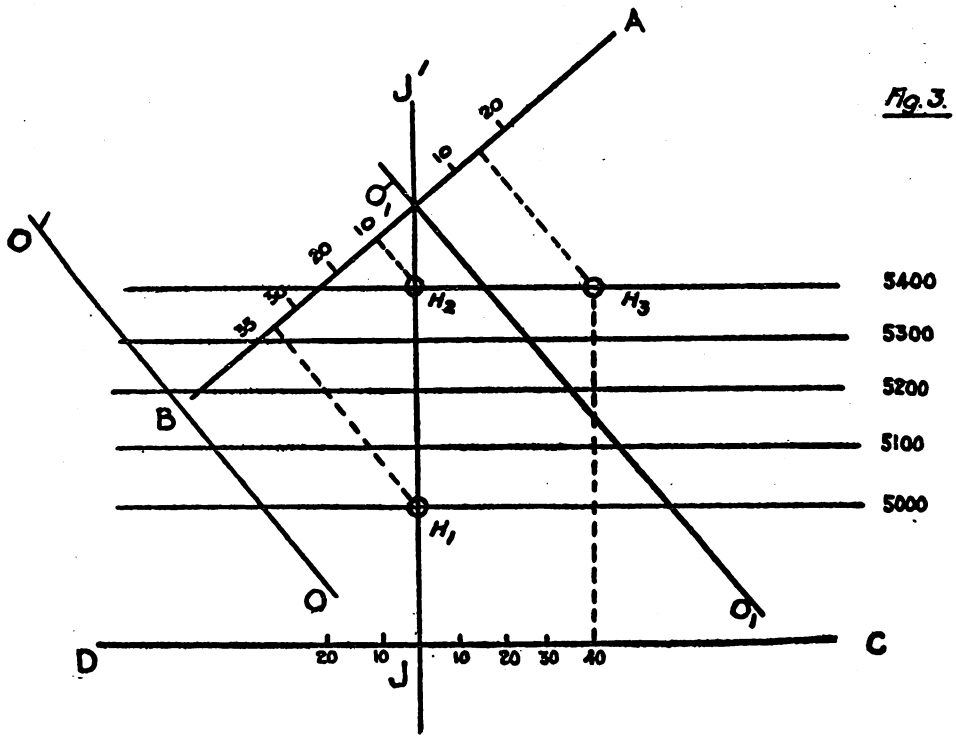
The author then mentions a suggested system of Dipl., Ing. Schwab, which appears to depend on a somewhat complicated procedure. He recommends its study—it appeared in the *Artilleristiche Monatshefte* of 1926, Nos. 231-234, but gives no details of it. He then proceeds

"The system of Lieutenant de Lombares (*Revue d'Artillerie*, July 1926), is very simple to use, and according to his statement it has been already well tested practically on the ranges. Let us draw on a message form lines of equal distance from the battery, say at 5000—5100 . . . . 5400 metres, and at right angles thereto in any convenient place the line of the opening round JJ′ and also the direction of the OP, OO′. Fig. 3. A group of four rounds (to eliminate the effect of the zone) is now fired on this line at each of the elevations 5000 and 5400, their M.P.I. is observed 35 graduations and 10 graduations left of the target. Call these M.P.I's H_1 and H_2.



If we draw through H_1 and H_2 parallels to OO′ the interval between them, 25 graduations, is as it appears at the OP. The scale

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AB and the direction in which the target appears O_1O_1' are thus fixed on the plan.

Now a switch is chosen and ordered, say about 40 graduations less (i.e. $2\frac{1}{2}$ degrees right) and another group of four shell fired at the same elevation (5400 metres). Their M.P.I. appears 15 graduations right of the target, and so the M.P.I. H_3 can be fixed on the plan, and since $H_2H_3 = 40$ graduations at the gun the scale CD for traverse at the battery is also fixed.

The order which will put the shell on the line OT can now be read off without further trouble. For example, if we keep 5400 we must order 25 graduations more (left) from H_3, if we keep the same line we must order 5150 to get an observable round. Normally we would bracket on the line O_1O_1' and use the appropriate side of the plan. Lieutenant de Lombares has, however, still further simplified the method in that he has changed the acute-angled co-ordinate system O_1O_1' JJ′ into a right-angled one. As this is slightly more difficult to understand, and as changing co-ordinates is not everybody's job, I have first described the method in the above easily understood form. It will now be easy to understand the following.

Instead of arbitrarily choosing the lines 5000, 5100, and so on, and from them fixing the scale, it can be done the other way round. Thus we take the axes JJ′ and OO′ with their scales at a convenient size, they should now be at right angles to each other, which can very easily be done on the back of a message form. We then fire the groups H_1 and H_2 and enter them on JJ′ with the help of the scale belonging to OO′. Fig. 4.

The switch 40 less (i.e. right) seen from the O.P. as before 15 graduations right of the target marks point H_3 on the plan. The lines of equal distance are all parallel to H_2H_3 and their dictance apart is fixed by the fact that $H_2H_1 = 400$ metres. We use the plan exactly as described above for the acute angled co-ordinate system.

Certainly the system has great advantages; it works regardless of any necessity for fixing the OP on the map, it demands no further appliances than a message form and '*elle affranchit le commandement de batterie de tout souci de réflexion.*' It seems, therefore very suitable for mobile warfare.

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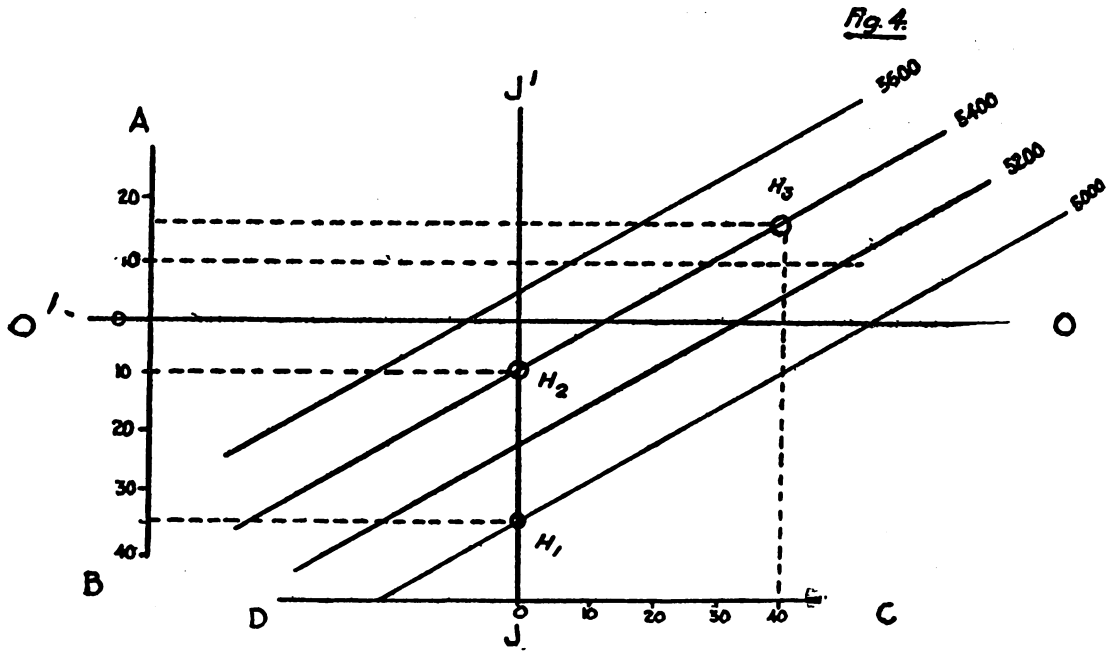

It is true that on close inspection even here also one can see the cloven hoof, in fact three of them.

1. Firing of preliminary groups is always a doubtful possibility, having regard to time and ammunition expenditure.
2. The system stands and falls by the accurate fixing of H_3, if by any chance (for example passing squalls of wind) the M.P.I. of these four shell is too short, the whole plan will be thrown out of gear.
3. The lines of equal distance are really not lines but circles, and the scale on each of them is different. If, therefore, the lateral deviation is large or the range very short, very noticeable errors may arise. In the purposely extreme case, range 2000 metres, deflection 100 graduations, H_3 would be 160 metres out in our sketch, though this error could be reduced by an appropriate choice for the range scale."

The author then touches on the system of Major Kovats Kalman of the Hungarian Artillery, which depends on the fixing of B, T, and O on the map and the preparation of tables of E/O and D/O factors. He then gives another proposition of his own.

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"Suppose again that the relative positions of O, B, and T can be fixed on the map. If only a small scale map is available these positions should be plotted onto a 1/20,000 gridded board.

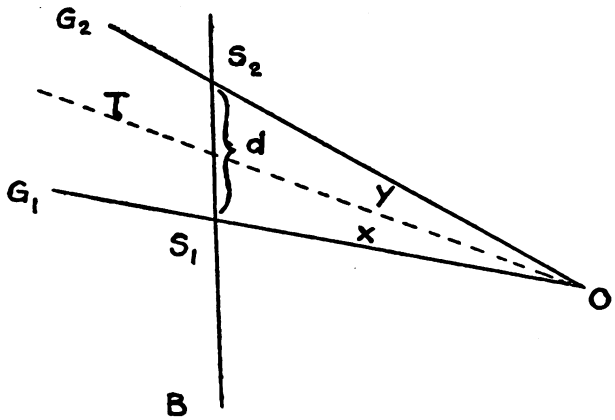

Fig. 5.

The first round now appears x graduations left of OT in the direction G_1. Fig. 5. We raise the elevation by a distance d metres, 100 to 300 metres according to the range, and size of x, and the next shell appears y graduations right of OT in the direction G_2. We plot the directions G_1 and G_2 in the plan with the help of a protractor. Now lay a ruler scale 1/20,000 along the plan so that the edge passes through B at one end, and swing it so that the lines OG_1 and OG_2 cut the ruler a distance d metres apart.

Then the first round must have fallen at S_1 the intersection of OG_1 with the ruler, and the second at S_2 the intersection of OG_2 with the ruler. Now the corrections necessary to lead to the target can be directly read off. We can continue with the ordinary bracketing method, or if the position of the fall of the shell is still doubtful we can repeat the procedure. It should be noted that one should not read off the distance BT (one does this generally on opening the shoot) but must decide how much one should drop from BS_2 or add to BS_1 to reach the target.

Here again the zone of dispersion is the fly in the ointment, but with two shell fired one after the other the conditions are so alike that it will only be small. Further it is assumed that the gun really answers to a correction of 100 to 200 metres on the tangent scale, which is certainly not much to ask from a fairly decent weapon. If the zone causes any heartaches to anyone, he can

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establish S_1 and S_2 as the M.P.I. of three or four shell. Against this disadvantage we can set two notable advantages.

Firstly it is not necessary to get the rounds on OT, which even with an accurate system is always a matter of luck, owing to the length zone.

Secondly, it is not necessary to work out the correction of the moment because the line BS_1 represents map range plus correction of the moment. S_1 is to a certain degree a witness point.

Finally, to the joy of many, this method involves neither tables nor mathematics.

For less capable mathematicians another expedient may be proposed, which represents a certain elaboration of the method in the manual. Let us assume that the target is so spiteful as neither to have any reasonable breadth, nor to offer any indication, by reason of a flat terrain, of its position on the map, for example, a periscope recognised as such from some distance off owing to its being carelessly turned round.

He who cannot work up any enthusiasm for tables or graphical methods can send out his B.C.A. or, if necessary any man, as far to the flank with relation to the line OT as is possible consistent with maintaining communication with him. This man only has to say whether he sees the shell right, left, or line. Visual is quite sufficient, but naturally telephone is better.

We thus construct for ourselves an artificial breadth of target, viz., the angle observer O—target T—auxiliary observer A, and carry on now according to the Manual, keeping the shell in this angle or in the corresponding angle behind the target. The bigger OA is the better. A favourable case is OA = 500 metres, OT = 2000 metres. Then the artificial target-width 200 metres away from the target is 50 metres, 100 metres away is 25 metres, and 50 metres away 12·5 metres, dimensions that a natural target rarely offers . . . . To make all clear; the shell must be so placed that O and A see the deviation in opposite directions, one right, the other left. If in spite of large changes of elevation the shell remains within the angle one knows that the line is considerably out, but if the smallest change of elevation is sufficient to move the shell out of the triangle, then must the line be nearly correct."

The author then just touches on cross observation, and then concludes :—

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"But what is the use of all these systems when nevertheless none of them provides the master-key? Well now, observation in the line BT is mechanical work, flank observation is Art. For the former, therefore, one can give a generally workable recipe, viz.: bracketing, for the latter, no!

One can easily show the young gunner the road on which he can reach the target, but if and how he does reach the target depends on his skill. *Shooting with flank observation is fundamentally dependent on the personal talents of individuals and on the kind of target which is being engaged.* It would therefore be a mistake to bestow all blessings on any single procedure, that cannot be; on the contrary it seems of the greatest importance to treat this problem in detail in the artillery school and in artillery instruction, each student can then himself soon find the method which most appeals to his taste, though certainly he should not make this choice until he possesses the necessary experience in the science of gunnery.

Since the present Manual fortunately allows so much freedom, it would not appear too grave a step to increase this freedom in the direction indicated, but not so that any duffer should be at liberty airily to loose off his shell; no, more than ever does the old saying apply 'only the expert can break rules.'

That the solution of the problem is really an Art can be seen from the fact that one can always quote new targets for which none of the systems dealt with up to date will lead to success.

For example, suddenly we see from a flank OP ten fast travelling tanks advancing, our own anti-tank defences are quite ineffective; shall we merely passively look on, with the excuse that the case is hopeless? That would be a deadly sin against the sentence 'Inactivity is a worse crime than is a mistake in the choice of method', and would be a sin against the spirit of the German Artillery. But here there is no recipe for certain success. The following suggestion is therefore given solely as an example.

The O.P. is on the right flank, the order runs 'All 5000. Echelon 100 metres. One round rapid fire from the right.' If the elevation is not hopelessly wrong we will be able to bring at least one round into relation with the target, especially as the tanks are moving. Observation. 5100 hid one tank from view. Order '100 more (all left 6 degs. approx.) 4800 echelon 100 metres one round

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rapid fire from the right.' Observation. 5000 metres falls the other side of one tank. At the same time the tanks jink half left. The supposition that they do so because of the fire does not appear unjustifiable. Therefore the order '50' less (all right 3 degrees) 'The whole battery 4900.' All shell appear left. Owing to the wheel by the tanks we have dropped the range too much. Order 'Distribute 10 from No. 2 (distribute 30 mins. from 2) 4900.' The third shell falls among the tanks. Order '20 less (all right 1 degree). Concentrate 10 on No. 3 (concentrate 30 mins. on 3) 4800.' At once the first shell falls close to the target. Without waiting for the remainder, therefore, the order is '20 less (all right 1 deg.) 4700,' and so on.

Whether we will thus really get hits we cannot foretell, but surely the moral effect, firstly on the tanks and secondly on our own infantry who see themselves supported, should not be underrated.

I have myself experienced a similar case on 31st July, 1917, on the first day of the battle of Flanders. When I was shooting on two advancing tanks I found it quite impossible, owing to the mist, to say if the shell were plus or minus, so I continued shooting in the faces of the tanks with an indisputably short elevation until they turned sadly homewards."

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TANK PROBLEMS PAST AND FUTURE.

By Major Justrow.

Translated from the *Militär Wochenblatt*, 25th September, 1928, by Colonel H. Rowan-Robinson, C.M.G., D.S.O.

THERE is no proof of the statement that the tank will play a decisive rôle in the war of the future. It is a fact only that the tank was a cause of our loss of the war in 1918; not, however, because it was unconquerable, but only because we did not initiate suitable defence measures when the enemy began his tank-building in 1915; and because, in 1918, when we recognised the full extent of the danger, the clumsiness of our machinery prevented us from making the necessary changes in time.

The tank, in principle, is no new thing. There has at all times been a demand for a weapon of great fighting power, speed and resistance. As armies grew it furnished the basic idea of armaments, varying according to the state of technical science in the particular period, varying too with the importance attributed at the time to the formation and employment of a technical arm within the framework of tactical leadership. It is not to be denied that, during the last war, the tank and anti-tank problems were treated by us with a certain indifference; nor that the authorities in the first years of the war assessed the morale of the troops and their tactical capacity too highly and omitted to make categoric demands for weapons required by the war conditions of the time.

Even among the ancient Greeks the threefold demand in the development and handling of weapons—power, protection, speed—was held to be an obvious necessity. Homer portrays his heroes in the Iliad armed with bow, sword and spear; he protects them with armour and shield; and increases their speed with the chariot. The three requirements are found in the most perfect relationship in the modern battleship.

Generally speaking it is only possible owing to the incompatibility of these requirements to effect compromises. Nature suffers from the same limitations and has to allow animals—beasts of prey, tortoises, gazelles—either a high fighting power, suitable armour or great speed. Everywhere we see, however,

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that the fighting power of attack (or defence) weapons plays the decisive rôle. Even the armour of the most modern and most powerful ships was unable to stand the penetrative power of shell in the great battles of the last war. It is hardly open to doubt that the tank attacks of the English and the French would have been defeated had we produced a suitable defence weapon and had it on the spot.

Since the war the tank has passed through many transformations. It has been enrolled in large numbers as a special weapon in foreign armies, and because of its size and strength has been given much too high a value. We, who are only looking on from a distance and are not bound to any existing equipment, must not lose our clear perception of the situation, which tells us that:—

1. The success of the tanks in the war was due to chance;
2. Every form of armour, if not overpoweringly strong, quickly becomes a sacrifice to a suitable shooting-iron; and
3. The speed of a tank will not compensate for insufficiency of armour so long as anti-tank weapons are able, by speed of laying, firing and hitting, to match the movement of the fighting vehicle.

I have written in detail on this subject in "Heerestechnik" and elsewhere. Here I will limit myself to the conclusions I drew there.

If weapons of high power are built into a tank, the latter necessarily becomes a vehicle of great weight, especially when a considerable quantity of ammunition is carried. Even more important, in this connection, is powerful armouring, which must be at least 22$^{m/m}$ (·88″) in thickness to be proof against the close fire of S.A.A., shell splinters and hand grenades. Against a direct hit from an armour-piercing shot of guns of calibre of 37$^{m/m}$ (1½″) and upwards and, at close ranges, against hits from even smaller projectiles, a thickness of 22$^{m/m}$ does not suffice. As an armour plate 1 square metre in surface by 1$^{m/m}$ in depth weighs 8 kg. (18 lbs.), one 22$^{m/m}$ thick weighs 175 kg., and thus, for armouring an inner space only of 2 m. × 2 m. × 3 m. a total weight of six tons is necessary inclusive of stays, bolts, etc. A space of 12 cubic metres is, however, very small, even for the most modest requirements of a fighting tank, and as 6 to 10 tons is the maximum weight allowed to the light tank[1] in foreign designs, it follows that only the most

[1] The expression "light tank" used in this article does not mean a light tank (late tankette) as we know it, but rather something of the size of our medium tank. *Trans.*

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important and vulnerable portions of such a tank can be provided with armour of 22m/m. All the remainder, particularly the under, back and side parts have to be much weaker, or, perhaps, cannot even be armoured at all. A tank which is attacked from underneath by a mine or from flank or rear by any other weapons becomes therefore an early casualty. Any exposure of the lightly protected side walls; a long movement parallel to the hostile line, or in a zig-zag course; or a long halt on the battlefield must be fatal to the tank. Descriptions in the papers of foreign tank manœuvres are often most disturbing, especially when these vehicles are employed in large numbers as a spectacle for the great, ignorant public. Such manœuvres, however, have nothing in common with the rough truths of war; for the most important factor, the effect of hostile fire, is not only not represented, but is often quite falsely appreciated by the military authorities concerned.

In order to escape from this fire effect as far as possible, the third requirement—that of speed—is needed in large measure. Great speed, however, presumes a relatively small weight and is therefore contrary to the weight-principle in the requirements previously mentioned. And to the weights indicated above we have to add those of the engine, the track and the whole mechanism. Indeed, when an attempt is made to build a thoroughly satisfactory tank, the difficulties tower up into infinity. The designer could only construct such a machine where the weight-limit was not imposed. As long, however, as the tank must submit to the conditions imposed by modern bridges and means of transport, so long will it remain inferior to the firearm. It is indeed a matter for earnest consideration whether or not, with due regard to fire power and speed, to abandon armour altogether and to use only mechanised guns which are simpler, cheaper, can be manufactured in larger numbers and can be employed in a much greater variety of ways than guns built into a tank with their limitations as regards seeing, hearing and laying. Moreover the tank requires a much greater train of workshops and mechanics and a bigger supply service for petrol, oil, etc., than are needed for the simpler and lighter mechanised guns.

Among troops of equal value provided with good anti-tank weapons, the tank can therefore play no important rôle. Only for an army which has to deal with an imperfectly equipped opponent

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who possesses no anti-tank defence, can the tank take any serious part. And in such case any other good weapon would do equally well. For us Germans, the light, armoured fighting vehicle is of no great value as we do not train with it in peace, and it would not be available in large numbers in war. On the other hand, its use by our former enemies, indicates the hope on their part of maintaining a superiority formerly won against a defenceless foe. Whoever has to deal with the attack of numerous tanks can, logically, do no better than concentrate his energies on the use of the anti-tank gun. He will then find himself—if not limited as we are by the Versailles treaty as regards number and calibre of guns—advantageously placed; for anti-tank guns are not only light and cheap to build, but are easy to handle and protect on the ground, difficult to knock out and—if some are destroyed—easy to replace. Anti-tank guns are, moreover, not like the tank, for use on rare occasions, but are of value throughout the battle and in all conditions of combat.

This is not the place to enter into the technical details of the construction of anti-tank guns. In any case, as I showed in "Heerestechnik," they must have a calibre of at least 20m/m to counter light tanks and of 37m/m to counter heavier tanks with armour up to 45m/m (1·8″) and to carry out their tasks successfully. The following table shows the penetrations of 20m/m and 37m/m armour-piercing projectiles and compares them to that of the 77m/m field gun :—

PENETRATION

of armour-piercing projectiles of 20, 37 and 77m/m with various muzzle velocities and at various ranges.

Range in metres	Calibre ...	20 m/m			37 m/m				77 m/m	
	Weight of projectile ...	0·14 kg. (·32 lbs.)			0·6 kg. (1·35 lbs.)		0·8 kg. (1·8 lbs.)		6·3 kg. (14·4 lbs.)	
	M.V. m.s. ...	1000	800	600	800	600	800	600	600	400
100	Depth in m/m of pierced armour plate	47	35	22	51	33	63	42	87	49
500		35	25	16	39	25	51	35	77	44
1000		24	16	11	27	18	40	28	67	40
1500		16	11	9	20	15	30	22	60	36
2000		11	9	7	16	12	25	18	53	33

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These figures are calculated for favourable conditions and can therefore only be used as a guide. The penetrations given must be considerably reduced for fire against particularly hard, highly tempered steel, when projectiles are badly shaped and when angles of incidence are oblique. It can be seen at once, however, that tanks can be effectively engaged—by 20$^{m/m}$ guns below 1000 m., by 37$^{m/m}$ guns below 2000 m., and by the 77$^{m/m}$ gun far over 2000 m. On the other hand, armour-piercing bullets out of small-arm weapons, even at close ranges, can only penetrate 15$^{m/m}$ of armour. No increase in calibre over 37$^{m/m}$ is desirable in view of the difficulty of ammunition supply and because a heavier weapon would not have the handiness in action necessary for dealing with quickly moving tanks.

Light tanks will not only be put out of action by the small calibre anti-tank guns but also by field guns of ordinary calibre firing H.E. shell. The chief difficulty for field guns not specially equipped for anti-tank work, and more especially for their detachments, is to hit a fast-moving tank. According to statements in the press, some of the lighter tanks in foreign countries have reached a cross-country speed of 30 km. per hour. A most important task in our training must therefore be to exercise detachments in picking up and following such targets. In the case of anti-tank guns, with their great handiness and quick traverse and with their low trajectories and high velocities at short ranges, the hitting of a tank, even when moving directly at the layer, should prove a matter of no great difficulty.

Of no less importance in training is the correct and quick distribution of fire when tanks are advancing in large numbers and the automatic switching of fire the moment the tank is destroyed. It is obvious, with such a mass of fire, that projectiles will only be distinguishable from each other and be directed on the right target if they have a satisfactory tracer. The smallness of the calibre of anti-tank guns demands a direct hit and therefore good laying. The field gun should also try and get direct hits by firing over open sights rather than hope for lucky shots in area shooting. The latter method is only justifiable when detachments are untrained, when fog and folds in the ground hide the tanks and when, in consequence of their large numbers, it is impossible to

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make a satisfactory distribution of targets or, in the absence of tracer ammunition, to distinguish the shell of separate guns.

A further task is to instil into the troops a moral consciousness of the undoubted material superiority of the anti-tank gun, so that they may not get nervous on the approach of tanks. The most dangerous tanks are those approaching end-on; at the same time they are the targets, from the point of view of laying, most easily put out of action. The faster the tank moves the less is it able to make use of its own weapons; the more it zig-zags the more it presents its weak side-walls as a target. The most dangerous case is where a company of tanks covers itself with smoke and thus prevents any engagement of individual vehicles during its approach. But the tank in this case is also prevented from using its weapons, and it furnishes a good target as soon as it gets near and breaks through the smoke. How difficult it is, too, for a moving tank to hit a small, well-concealed gun!

A forecast as to the future of the tank is, like every other prophecy, dangerous. The man who remains silent in the background loses nothing but profiteth nothing. He has, however, the advantage of being able to ride the high horse when some bolder spirit makes a mistake. In spite of this it is a pleasing task for the military artist to predict the future; for it is the business of armies to prepare for future wars, in contrast to people in civil life who have only to fulfil the needs of the present. I am convinced that a war between two equally well equipped opponents will prove the unsuitability of light tanks for their allotted tasks. They will be able to count to their credit a few successes gained by surprise; but, generally speaking, countless tank-corpses will cover the battlefield and serve both sides equally as fire-cover in their attacks. We can, in consequence of this probability, discern in current literature a hankering, which flickers up at intervals, after quite heavy tanks with armour 100$^{m/m}$ thick and a weight of 100 tons. How far such designs are likely to be of use is difficult to determine. The chief obstacle to their development is the difficulty of their transport to the battlefield. These giants, pricked out with a large number of effective guns and machine guns would be unconquerable by any small anti-tank guns and even by field guns. Even alone on the battlefield they would, like an armoured fort, have

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considerable value. In contrast to the light tank they would be able to remain there for a long time in one place. They would be able to pour their whole fire-power on the enemy undisturbed; and they have the advantage over armoured forts in that their mobility saves them from being surrounded.

The heaviest tanks must, however, at long last succumb to heavy artillery. No tank can be built so strongly as to be invulnerable to every kind of projectile. It is also impossible, from the standpoints of equipment, expense, supply and tactical employment, to supply troops with anti-tank guns of 15 and 21c/m as well as with anti-tank guns of small calibre. Heavy guns of these natures can thus only be used as a special reserve for emergencies; on the other hand giant tanks can also only be used in special cases and then in small numbers.

Hence I come to these conclusions :—Endeavours will be made to enlarge the power of tanks both as regards fighting capacity and protection. Ways and means will be found to bring such tanks over trenches, brooks and rivers up to the battlefield. To deal with them there are two courses open—the first to utilise the engineer protection of tank-traps and special explosives which must always be carried; and the second to employ heavy artillery as mentioned above. It would be going too far in my opinion to construct special anti-tank weapons of a calibre over 37m/m to deal with the heaviest tanks, for these weapons would lose in value in the front line as their weight increased.

I have no wish to underestimate a mass attack of light tanks against our own unprotected lines. The tank-ghost is, however, beginning to spread out his arms too wide, in spite of the fact that he does not fulfil his rôle, as the ghosts of the gas-weapon and of the bomb succeed in doing.

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CAMPAIGN SUMMARY AND NOTES ON HORSE ARTILLERY IN SINAI AND PALESTINE.

By Lieut. E. L. Sibert, F.A.

(Reprinted from the U.S. *Field Artillery Journal*, May-June, 1928.)

TO gather such meagre facts as I have included below, it has been necessary to comb through a mass of matter on the campaigns in Palestine and Sinai. To Lieutenant-Colonel The Hon. R. M. Preston, I am indebted for nearly the only direct opinions on employment of horse artillery that I have been able to find. He is an artilleryman himself, which explains his having included a number of valuable remarks on this subject in his very interesting book, "The Desert Mounted Corps." Practically all the other writers saw in these campaigns only the remarkable use of cavalry in modern warfare.

Some of the most frank and detailed accounts of the mounted work are contained in Vol. VII of the "Official History of Australia in the World War," and Vol. III of "Official History, New Zealand's Effort in the Great War." The horse artillery supporting the Australian and New Zealand troops, however, were not of Anzac origin, but were English and Scotch territorial batteries. Though they are mentioned most cordially and their efficiency very favourably commented upon, there are no detailed accounts of their work.

The United States Cavalry School History of the Palestine Campaign naturally deals solely with the cavalry. "Allenby of Armageddon" though more or less the biography of a cavalryman, gives little space to his handling cavalry in the Palestine campaign, and none to artillery. The only histories of horse artillery units in this campaign were found to be of limited edition, out of print and unobtainable.

Lawrence's really remarkable book, "Revolt in the Desert," though full of interesting side lights, contributes little to our narrow subject.

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In order to keep the reader oriented and to help him keep events in their proper chronological order, I will include first a short outline of the campaign.

We will then proceed to examine the campaign in detail for points of interest to the artilleryman, taking up those particular actions that furnish interesting examples of horse artillery support.

General Murray took command of Eastern Egypt in January, 1916. He believed that the defence of Egypt should be undertaken on the southern border of Palestine, instead of at the canal.

In preparation for an advance he caused to be started a railway to Katia, and British troops occupied or patrolled the area thirty miles east of the canal. In July, 1916, the Turks made an attack in force on Katia and were repulsed. Most of the rest of the year was devoted to raids, reconnaissance and pushing forward the work on the railroad.

In December, 1916, the British again advanced practically unopposed. The Turks made a stand at Magdhaba and Rafa, both of which places, including many prisoners, were taken by British mounted troops. The British lines were now stabilised until the railroad and pipe lines could be extended to Rafa.

The Turks meanwhile took up a strong defensive line from Gaza to Beersheba. Late in March, 1917, the British with all arms made their first attack on Gaza; which was unsuccessful and costly. On April 17–19th the second attempt to carry this place was made. The attack again failed with even more severe losses to the British. Stabilised warfare conditions now set in. Morale was low and interest and support from home showed a marked falling off.

Many military authorities in England believed, in accordance with the first principle of war—that England could best help win the war by using nothing but the defensive at any threatened subsidiary points such as the Suez or Mesopotamia, and using every other available man, gun and penny on the western front in France to take the offensive against the enemy main force. This viewpoint had been more firmly established by the costly and sad Gallipoli failure.

Lloyd George, however, considered the Turkish Army as actually the left wing of the Central Powers' front, and believed

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that a victory against it would be as fruitful as a victory against the powerful right wing in Flanders. Accordingly he looked for a strong successful leader to send to Palestine.

After a careful search his choice fell upon General E. H. H. Allenby, who had gone to France with the first regular troops in 1914. He had had an excellent record in the Boer War as a cavalry leader, and also had a guiding hand in cavalry training in the period just prior to the World War. In the first B.E.F. he commanded the cavalry division, and within a short time was given command of the newly formed cavalry corps. He later successfully commanded the Fifth Corps and soon after the Third Army in Picardy. His leadership in the Somme Offensive in October, 1915, and again in the spring of 1917 earned him universal praise.

Lloyd George's selection of General Allenby to command in Palestine therefore naturally met with favour. The new commander's plan to reinforce the Palestine front, however, was only carried through after a considerable fight with the London military powers.

Allenby's arrival in Palestine marked the beginning of a decidedly new era. More troops, better equipment, aeroplanes, and heavy guns arrived. Morale went up and intensive training, reorganisation and preparation set in.

The new general found the enemy holding an organised position from the sea north-west of Gaza to Beersheba, about thirty miles to the south-east, the country to the east of the latter place being extremely rough, trackless and waterless. To all intents and purposes, therefore, this thirty-mile line was considered to rest on two impassable obstacles, the sea on the west, and the rough arid highlands of central Syria, on the south-east. Beersheba itself contained practically the only water within miles to the east, west or south, of that place.

The opposing British lines were extended for about twenty miles, from the sea at Gaza to Gamli, roughly parallel to the Turkish lines.

Allenby's plan was simple. With a demonstration at Gaza, his main blow was delivered at Beersheba, enveloping the enemy's left and rolling his line up toward Gaza.

The attack began on October 31st, 1917. By dark the mounted

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troops had galloped into Beersheba and the Turkish left was in full retreat. The next move was another demonstration at Gaza to immobilise the reserves there and prevent any reinforcement of the central position at Sheria. This attack on Gaza was made on November 2nd and not only prevented the withdrawal of reserves, but gained many strong points and actually attracted most of the available reserves from the rest of the line.

On November 6th the Sheria—Hareira position was stormed and taken and the entire Turkish line gave way. The pursuit was immediately taken up, during which many stiff rearguard actions developed.

The country fought over was practically waterless. Roads did not exist and the going was exceedingly hard.

From November 7th to November 11th the advance on the part of the British was made by the Desert Mounted Corps east of the Ramleh—Gaza railroad and by two infantry divisions in the country west of it to the sea. The other infantry divisions gave up their transport to enable these two to go ahead.

On November 11th the enemy took position on the Nahr Sukereir, but were soon driven out by the capture of the Tel El Murre and Burkah. The advance now inclined to the east. The Katrah—El Mughar line was overrun and the British forces pushed on towards Ramleh and Ludd. These two towns and Jaffa being soon taken, there ensued a pause to await the progress of railroad construction and reconstruction.

Hence on November 16th General Allenby's army held the line Jaffa—Ludd—Ramleh—Junction Station, with a division of mounted troops north of Beersheba on the Hebron Road. In seventeen days the army had advanced over sixty miles and had captured over 9000 prisoners, and large quantities of matériel and stores!

Allenby now stabilised his left in defensive positions and reached to the east. His plan was to cut the Nablus road north of Jerusalem and thereby isolate that city. At this stage the Turks began to recuperate from their first panic, and were in addition, strongly reinforced with some of the best Turkish troops from other fronts. The difficult terrain, mud and cold (the winter rains having set in), added to the coming of these reinforcements, caused the British many costly delays and rebuffs.

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In addition to cutting Jerusalem off on the north, a British division was to come up on the Hebron road and get across the Jericho road east of the Holy City. These advances finally succeeded but not until the Turks had withdrawn from Jerusalem.

That city surrendered on December 9th, 1917. The total of prisoners taken since October 31st was brought up to 12,000 and of captured guns, up to 100.

The British lines now ran from just north of Jaffa to just north of Jerusalem and then bent back to the south. These lines were consolidated, the troops re-supplied, communications improved and everything in general tightened up for one more effort.

This came on December 20th when for three days a battle raged on the left which resulted in an advance of several miles, far enough to make Jaffa safe to use as a base for unloading ships.

Again on the 27th for five days, attack and counter-attack immediately north of Jerusalem again resulted in a gain of enough miles to make Jerusalem safe from immediate threat.

The next move came on February 19th when one infantry and one cavalry division struck to the east down through the well-known wilderness of Christ's temptation, to Jericho and the northern inlet of the Dead Sea (*i.e.*, where the Jordan runs into the Dead Sea).

The country was the roughest yet met with and the weather most inclement. The 60th Division and the Anzac Mounted Division, however, fought their way through and captured Jericho on February 21st, and on the evening of the same day held the Jordan from the Dead Sea up to near the El Ghoraniyeh bridge.

Again early in March, the 60th Division pushed north along the Jordan until the Turks evacuated their bridge-head covering the aforementioned bridge.

These operations thus securely established the British right.

It must be remembered at this point that the Arab tribes in Arabia had under Feisal, declared their independence and inspired by Lawrence, were carrying on a desultory guerilla warfare against the Turks in the Hedjaz.

The Turkish communications to this front lay temptingly open, across the Jordan and up on the highlands of Moab, from the new British right.

At Amman, the Hedjaz railroad ran over a viaduct and through

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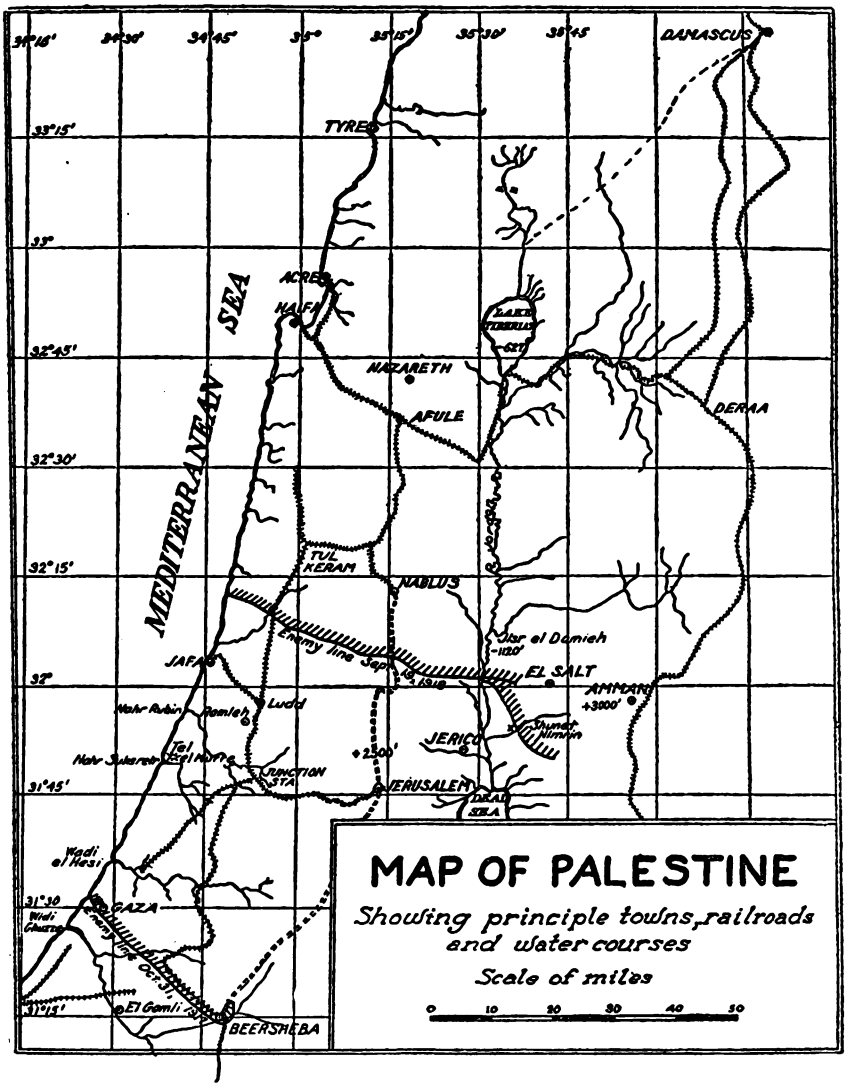
MAP OF PALESTINE
Showing principle towns, railroads and water courses
Scale of miles
0 10 20 30 40 50
DAMASCUS
TYRE
ACRE
HAIFA
LAKE TIBERIAS
NAZARETH
AFULE
DERAA
MEDITERRANEAN SEA
TUL KERAM
NABLUS
JORDAN
Enemy line Sept. 18, 1918
Jisr el Damieh
EL SALT
AMMAN
JAFFA
Ludd
Ramleh
Nahr Rubin
Nahr Sukereir
Tel el Hofr
JUNCTION STA
JERICO
Shunet Nimrin
JERUSALEM
DEAD SEA
Wadi el Hesi
GAZA
Wadi Ghuzze
Enemy line Oct. 31
El Gamli
BEERSHEBA
34°15'
34°30'
34°45'
35°
35°15'
35°30'
35°45'
33°15'
33°
32°45'
32°30'
32°15'
32°
31°45'
31°30'
31°15'

a tunnel. Quite naturally a raid against this place was conceived and launched. Amman is thirty miles east of Jericho. The first five miles is flat, but in the next twelve the ground rises 3500 feet, and is extremely rough and crossed by only one real road.

The raiding force consisted of an infantry division and a cavalry division. Starting March 21st the forcing of the Jordan took nearly two days, thereby vitiating most of the surprise element. The raiders doggedly advanced into the mountains and fought their way toward Amman, against minor enemy resistance for three days and nights. All wheeled transport had to be left behind and the command suffered severely from the rain and cold.

By March 29th the advance was at a standstill just east and south of Amman, though some demolition of the railway had been effected.

On the night of the 30th after a day of final effort, orders were given to withdraw. Turkish reinforcements had arrived both at Amman and north of the route back to the river crossing, near Es Salt. By evening of April 2nd after many delaying actions the command was back west of the Jordan.

The next operation of any importance was the Es Salt Raid, the plan being to work to the rear of the Turkish position at Shunet Nimrin and capture Es Salt, thus severing the communications of the Turkish forces immediately east of the Jordan. Two cavalry divisions and one infantry division reinforced with Indian brigades composed the raiding force.

The Shunet Nimrin position was attacked and masked according to schedule while the mounted troops, leaving the 4th Australian Light Horse Brigade and three horse batteries to keep its line of retreat clear, pushed on to Es Salt and captured it. Expected Arab co-operation failed to materialise.

The enemy, however, quickly reinforced this end of his line from the west and elsewhere and made the British withdrawal not only necessary but very difficult. The 4th Australian Light Horse Brigade lost two of its batteries and nearly lost itself; while the retreat of the Australian Mounted Division from Es Salt was made under very stiff pressure.

May 4th saw the restoration of the original positions on both sides, after five days of fighting.

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Nothing of any magnitude or importance occurred in the Jordan valley until the Turks attacked on July 14th and were counter-attacked and ejected from the British lines near Musallabeh and Abu Tellul.

The next act came in September, 1918, when Allenby massed most of his cavalry under cover on the coast; left a small but active force in the Jordan valley, and attacked on the coast for a "break through." The break through was achieved and according to plan, three divisions of cavalry trotted through the gap near the sea and drove on to the north.

By noon of the 19th of September, seven hours after the attack started, the cavalry was eighteen miles to the north, and soon after through the passes to the north-east into the Plain of Esdraelon. The 4th Cavalry Division reached Beisan the evening of the 20th, having covered eighty miles in thirty-four hours; the 19th Lancers securing the bridge over the Jordan at Jisr Mejamie, ten miles further north. On the 22nd the New Zealand Mounted Rifle Brigade seized the bridge at Jisr el Damieh.

Thus within less than four days all the routes of withdrawal for the Turkish armies east of the Jordan had been closed. By September 24th the last remnants of the VII and VIII Turkish armies had been rounded up, the infantry driving the panic-stricken Turks into the cavalry's arms.

In the interim, the cavalry had captured Acre and Haifa. The net result of the operation was the clearing of the whole of Palestine west of the Jordan and the capture of 40,000 prisoners.

On September 23rd Es Salt, east of the Jordan, was taken, and Amman on the 25th, the Enemy Fourth Army retreating to the north along the Hedjaz railroad in a demoralised condition. The II Turkish Army at the same time started its retreat toward Amman from the Hedjaz pursued by the Arab Army. On the 28th, this army surrendered to the British without a fight.

The Desert Mounted Corps was now ordered to Damascus with all speed as some 40,000 Turks and Germans were either in it or retreating toward it. The race to this place was made against some opposition. The British troops were in two columns, the Australian Mounted Division and the 5th Cavalry Division in one, the 4th Cavalry Division in the other.

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The first-named column had actions at Benat Yakup, Kuneitra, Sasa and Katana, before it reached and closed the north and north-west exits from Damascus on September 29th. The other column after fights at Irbid and El Rempte and after joining the Arabs, entered Damascus the morning of October 1st, 1918. However, about 17,000 Turks, the last remaining in Palestine, had succeeded in escaping northwards in a disorganised mob.

Thus ended Turkey's rôle as a combatant in the World War.

So much for the general narrative of the campaign. Now to examine particulars.

A British or Australian Mounted Division consisted at first of four brigades (about 2100 men each) plus a brigade of three horse artillery batteries of four guns each (13 prs.). Later the divisions were reduced to three cavalry brigades each. In addition there was a Field Squadron (Engineers), Signal Squadron and Medical, Veterinary and Supply units and trains.

At the end of the campaign it was a matter of more or less general agreement that the British Cavalry Division was under-gunned, both as to weight of metal and numbers; and the cry went up for the light howitzer (*i.e.*, the 4·5″ or similar weight).

What was deemed ideal was a brigade of light guns and a battery of light howitzers in each division. This plan, however, contemplated six guns per battery. This would leave out cavalry divisions, by comparison, woefully under-gunned.

The British had from the first until well on into the campaign, one battery of 13 prs. assigned to each brigade.

The disadvantage of such a scheme is only too evident, and was thoroughly condemned by the artillery and remedied later. Brigades in reserve often kept their batteries with them, and fire direction in support of the action viewed as a whole was, of course, unusual.

Seldom in accounts of the campaign could be found incidents where the horse artillery was so left behind by fast marches as to be out of the fight. September 19th and 20th, 1918, the Notts Battery accompanied the 3rd Australian Light Horse Brigade fifty-one miles in twenty-five hours and then ten more miles in seventy minutes. Many times they could not keep up or follow at all because of the lack of roads, as on the trans-Jordan raids, but

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no wheeled vehicle of any description could do the trick. Hence we may assume that the weight of their guns, the 13 prs. (about 2000 pounds), was not excessive. Even during the early part of the Sinai campaign when the batteries were armed with the 18 pr., no failure to keep up was noted, and the 18 pr. is a heavier gun than the French 75m/m.

On the other hand, time and again we note that the 13 prs. could not do the requisite damage or were outranged, and heavier metal was prayed for by those most interested. Naturally the problem is one in which mobility is the limiting factor. It would seem, however, that our 75m/m is probably as good a gun for the purpose as any now in use, falling, as it does, between the 13 pr. and the 18 pr.

The 105m/m howitzers need only be sent along when the nature of the mission would indicate that they could catch up in time to have an influence on the action. Horse-drawn 105m/m howitzers have the mobility, certainly, of any division train, so we may assume that their inclusion would be normal and the cases when they could not be used, abnormal.

While on the subject of matériel it is worthy of note that the pack horses carrying light wire reels were used early in the Sinai campaign and presumably throughout the later campaign. The arrangement was very similar to our modified pack artillery reel now in use at the Field Artillery School.

Another unusual feature was the use of so-called "ped-rails" on the wheeled matériel of the firing batteries. These were improvised wooden caterpillar treads kept in place much as chains on automobile tyres are. There use was restricted to the sandy desert. Pictures of batteries in action show sandbags used in place of trail logs when in position in sandy country. Carrying prepared trail logs was undoubtedly frowned upon because of the extra weight they would impose.

When it became necessary to move heavier guns through the sand, men preceded the guns and dug shallow tracks for each wheel to follow. The tracks were filled with brush cut nearby.

Again, for even the light guns moving through rough places where the going was particularly hard, the guns and wagons of the firing batteries were double teamed, it being necessary to immobi-

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lise the rest of the battery (and combat train) to make this possible.

Naturally under such conditions we hear of the batteries running out of ammunition, as at Rafa when the Inverness Battery supporting the New Zealand Mounted Rifles Brigade had to be sent to the rear. In this particular case, however, the small arms ammunition in the firing line gave out as well, so that the New Zealanders, forced to do something, charged home with the bayonet and took the enemy's Central Redoubt, thus turning the tide of battle at a most critical point.

By the very nature of cavalry and its use, we are taught not to expect sustained actions, so that the exhaustion of even the ammunition carried in each section may be regarded as unlikely. If the action lasts long enough to do this, surely the combat trains will have had an opportunity to close up.

Now to inquire into the use and care of animals.

One writer, Colonel Powles, states, in speaking of the Sinai campaign: "In this campaign our men became true horse masters; and it can be safely said, that in no campaign of which history has cognizance, has the horse been so well understood in all his needs, and so well fed and tended."

The hot dry climate apparently suited the horse, which is not strange considering the fact that practically all of their horses, as are ours, were of Oriental extraction. At first, the British, as do the French, erected shelters whenever possible to protect their horses from the sun. When this no longer was possible, practically no bad effect was noticed. Later in the Jordan valley under conditions which were almost unbearable for men, the horses maintained their condition wonderfully. There, the heat, dust and flies were appalling. (It is to be remembered that the Dead Sea is 1200 feet below sea level.)

In between these two periods of heat, for periods as long as six weeks the troops encountered rain, mud and piercing cold (comparable to the average rainy "Norther" experienced in Oklahoma, Texas and Northern Mexico) and in the winter of 1918 the horses often found themselves standing in six inches of snow.

Colonel Preston states in his "Desert Mounted Corps" that the opening of the cavalry operations, presumably September, 1917, found the animals in an unsatisfactory state of health; that what-

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ever their outward appearance may have been, their internal condition was by no means good. Two years of indifferent forage and the large quantities of sand consumed with their food had more or less permanently injured their digestive organs. Though sand colic had ceased to trouble the command, the effect was still present as proven by most of the post-mortems.

He further states that about ninety per cent. of the draft horses had strained their hearts to some extent during the terrible work in the Sinai desert. This is somewhat offset by the statement of the Brigade Major of the New Zealand Mounted Rifles Brigade that their horses started the Beersheba operation in the very pink of condition.

Colonel Preston maintains that the experience of the campaign proved that horses cannot be too "big" in condition at the commencement of operations provided they are kept adequately exercised. "The really fat round horses finished both series of operations in better condition than those who looked harder and more muscular, but not so fat, at the beginning." This was especially the case in the first series, during which the shortage of water was so acute. This seems to be in keeping with the usual British theory of throwing all the grain possible into their hunters during the conditioning period. It would seem that the explanation of the fat horses finishing in better shape, is that they were the natural "good doers" of the command. That is, they were fat when others were thin, under presumably identical conditions of feed and exercise even prior to the campaign.

Remarks on forage are of indifferent interest to us, particularly as regards to kinds of grain, as they were local varieties hardly likely to be encountered by our service. The daily grain ration consisted of ten pounds of whatever grain was available. Such things as barley or gram were the staple issue for long periods. For hay they used ten pounds of chopped barley straw, when obtainable. Later during more active operations the ration was nine and one-half pounds of grain (barley or gram) and nothing else. This was only about two-thirds of the normal garrison ration. Gram, or maize, caused the horses to scour badly, "thus increasing the weakness engendered by hard work and starvation." After the advance from the Gaza-Beersheba line, limited grazing was possible.

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The subject of watering in these campaigns is particularly interesting.

It should be appropriate to include at this point, some official correspondence on this matter.

"G.O.C., DESERT MOUNTED CORPS:

I shall be glad if you will be so good as to let me have the following details as regards the animals of any of the units under your command during the period 1/11/17 to 31/12/17:

1. The longest period they were continuously without water.
2. The work performed during this period.
3. Whether they fed well when they were thirsty.
4. The average number of times they were watered daily during the period specified or during any intermediate period.
5. The smallest amount of grain and fodder they received at any time and for what period.
6. The average amount of grain and fodder they received during the whole or any intermediate period.
7. The maximum amount of grain and fodder they received at any time and for what period.
8. To what extent were units able to supplement their forage locally, by grazing or otherwise.
9. When was there any noticeable change in their condition and vigour as a result of work and privation.

(Signed) G. R. BUTLER, *Brig.-General,*
Director of Veterinary Services, E.E.F."

G.H.Q.,
1st Echelon,
31/1/1918.

"HEADQUARTERS,
DESERT MOUNTED CORPS.

With reference to your . . . . herewith report in detail as asked for:

1. (a) One cable wagon team from D.H.Q. was without water for a period of 84 hours.

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(b) Several regiments in the two Australian Brigades were without water for a period of 60 hours.

(c) The N.Z.M.R. Brigade was without water for 72 hours.

2. By (a) above, almost continuous work, cable laying, which entailed heavy work partly over rough country.

By (b) above, fast travelling and reconnaissance, averaging about 20 miles each day.

By (c) above, first two days reconnaissance, averaging about 20 miles per day, remainder of period practically no movement.

3. Yes, up to 36 hours; after that, in most cases, they refused to eat.

4. During the period of advance, once per day, *i.e.*, to 15/11/17, after that twice daily.

5. Four lbs. grain and no bulk fodder for 24 hours.

6. An average of 9 lbs. grain with average 4 lbs. Tibbin requisitioned from inhabitants up to 17/12/17. From 17/12/17 to 31/12/17, 12 lbs. grain and average 4 lbs. haystuffs.

7. As shown in last period in paragraph 6.

8. An average of 4 lbs. haystuff per horse was obtained from the inhabitants throughout the whole period of operations. Grazing nil.

9. Decided falling off in condition and vigour after 36 hours without water. With good food and water horses picked up remarkably, though it is to be observed that all units report that issue of grain on five consecutive days caused serious trouble, the horses suffering from diarrhœa and laminitis and losing vigour. With reference to the cable wagon team which was without water for 84 hours, though much distressed at the end of that period, these horses quickly recovered. It is to be remembered that the horses of the Division commenced operations about 26/10/17, in excellent condition, which is largely responsible for the fact that evacuations on account of debility have been extremely small, both during operations and afterwards.

(Signed) E. W. C. CHAYTOR, *Major-General.*
Commanding,
Australia and New Zealand Mounted Division."

12/2/18.

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NOTE.—The horses of one Brigade had an indifferent watering only on morning of 6th, and watering next during the action on the 8th, no more water until during the night of 10–11th. They were greatly distressed on the 10th, but by the 13th were, with the good water and rest, fit for work again, though they lost considerably in condition.

Another report tells of one battery marching and fighting for nine consecutive days, watering only three times during this period.

The Royal Army Veterinary Corps, to get some interesting data, instituted a plan whereby a large number of horses of similar type and condition were divided into two groups, one to be watered twice a day and the other three times. "The result of these experiments was conclusively in favour of the two drinks a day. Not only did the horses on this régime improve in condition quicker than those which were watered three times, but it was proved by actual measurement that they drank more water in the day. By the time the force arrived at El Arish, watering twice a day was generally accepted as a standard." (Colonel Preston in "The Desert Mounted Corps.")

This is a startling contradiction of our teaching of "water as often as practicable."

Later when necessity forced the command to be watered in many cases only once a day, a certain loss of condition was noticeable, although this period (May to October, 1917) was a hard one in every way.

Colonel Preston goes even so far as to claim that if horses get water once a day and are given anything in the nature of bulky food (to supplement the grain ration, presumably) such as grazing, there is no reason why they should not be able to continue indefinitely.

During the Beersheba—Jerusalem operations the average watering per horse in the mounted troops was once in thirty-six hours.

In remarks on types of horses Colonel Preston urges that all horses in a horse battery (except officers' mounts) be of draught type, and that the draught type be light and well bred rather than heavy and coarse. This of course brings us to the inevitable impasse concerning the "ideal artillery horse." He states that nothing in

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the nature of a cart horse can live with cavalry in a march of forty miles.

The horses of the Mounted Corps had an excellent health record as regards disease, due of course to the excellence and efficiency of the British Veterinary Corps. Practically every account of the campaigns includes praise for the veterinary officer.

Leather muzzles are recommended by Colonel Preston to prevent hungry horses from eating picket ropes, wooden wheels or anything else they come in contact with. Steel wire picket lines and halter shanks are also recommended as they last for ever, do not burn a horse that gets his foot over one of them, nor do they weigh more.

In the Australian Light Horse regiments neither manes nor tails were ever cut or pulled. The advantage and benefit of this in hot sunny fly-infested climates is evident. Such a practice, under such conditions, is strongly recommended.

Tactical employment.

The so-called normal cavalry offensive action is a quick affair. A development and holding of the enemy in a dismounted fire fight by the pivot of manœuvre. Meanwhile the mass of manœuvre rides to a "take off" position from which the main attack is launched, wholly mounted or partially so.

One writer describes one as follows: "The day's action brought into play the full attacking powers of the mounted arm against an enemy in position. There was the mounted advance to the first fire position by one regiment, and then its systematic capture of enemy trenches on foot as infantry with rifle and bayonet and Hotchkiss and machine guns, and its rapid reinforcing on horseback of the successive positions when captured.

With the other regiment there was the advance mounted under cover of artillery fire to successive fire positions; the rapid seizing of small tactical features at the gallop; the outflanking of the enemy position by aid of the mounted man's mobility; and finally there was the magnificent mounted charge by which the red knoll was captured."

This was the fight at Ayun Kara, November 14, 1917.

An interesting example of horse artillery in support of such an

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action is the attack on Tel el Saba (part of the Beersheba defences).

"At eleven o'clock the Somerset Battery moved up and ranged on the hill (enemy entrenchments) at 1300 yards. Enemy machine guns were giving much trouble and were not located until the afternoon when Lieutenant Hatrick, Signal Officer of the Auckland Regiment, from a concealed position in the front line observed for the battery and directed fire by flag signal. A section of this battery was then moved around to the east of the hill to deal with machine guns in position on the high ground, etc."

Time and again we read of similar incidents. Direct laying was by no means unusual and it is remarkable what light losses such boldness entailed.

Again we find in the withdrawal from Sheikh Muaunis that "the evacuation was skilfully carried out with the help of the Somerset Battery firing from a position 1400 yards south of the village on the south side of the river. This battery remained in action until after the village was occupied by the enemy and the commanding officer of the Battery (Major Clowes), who was in the village observing, had to swim the river."

Another incident of artillery boldly used in a withdrawal, which terminated somewhat disastrously, was the fight of the 4th Australian Light Horse Brigade to protect the line of communications with Es Salt. Here three batteries supporting one brigade were left in the foothills to guard the two routes leading from Es Salt to the Jordan, while the rest of the command raided Es Salt. A force of Turks estimated at about 5000, with some artillery and cavalry, crossed the Jordan higher up, and instead of going after the raiders, attacked the guard left on the line of communications.

To quote: "The brigade was now, however, in a very difficult position. Our troops had been forced back till they were facing due west, with their backs to the tangled maze of rocky hills, impassable for cavalry and guns. Some of the Turks were across their line of retreat to the south, though only in small numbers as yet. Others were working round the right flank of the brigade. All along the line our troops were hotly engaged at close quarters. To withdraw to a flank under such conditions was a very hazardous operation, but it appeared to offer the only chance of extricating the brigade from its desperate situation.

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"Two regiments of the New Zealand Mounted Brigade, which had been co-operating in the attacks on the Shunet Nimrin positions from the south, had been dispatched to the assistance of the 4th Brigade, but they had fifteen miles of bad ground to cover, and could not possibly arrive in time to save the position. The most they could hope to do was to form a rallying point for the 4th Brigade to fall back upon.

"The 4th A.L.H. Regiment, on the right flank, held on till the enemy closed to within 200 yards, in a desperate effort to cover the retirement of our guns. 'A' Battery, H.A.C., was in this sector of the line, the Notts Battery, R.H.A., near the centre, and 'B' Battery, H.A.C., at the south end. The position of the two northernmost batteries was quite hopeless. Driven back to the verge of the impassable hills, they were in action in the open in the front line, and the only way of retreat feasible for wheeled vehicles was to the south, down the line of our troops, and in full view of the enemy at a few hundred yards distance.

"Nevertheless the two batteries fought steadily on, attempting the impossible task of retiring by sections to the left flank. Each time a Turkish attack broke and melted away before their fire, the enemy dead lay a little closer to our guns. Each time a short retirement was made, the heavy pressure of the enemy pushed the guns farther into the hills; and each time there were fewer men and horses to move them. At last they were forced into a position from which there was no way out, and here they made a final stand, fighting till all their ammunition was exhausted, and the Turks were within two or three hundred yards on three sides of them. Even then a last effort was made to find a way out, but the teams were mown down by machine-gun fire, and the guns had to be abandoned. The remaining men and horses scrambled up the hills to the east, and succeeded in reaching the Wadi el Retem. The Australian troopers accompanied them, fighting grimly and silently, as an old dog fox, run into by the hounds, turns on his pursuers, slashing right and left, and dies with his teeth locked in a hound.

" 'B' Battery, H.A.C., having a shorter distance to go, succeeded in retiring to the south, through the enemy, and came into action again near the Umm el Shert track, to cover the withdrawal of the rest of our troops. During its retirement a gun was over-

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turned in the bottom of a deep wadi, and had to be abandoned. A party of men, under an officer, descended into the ravine, and made a fine effort to right the gun and get it away; but the Turks appeared on the banks above, and opened fire on them with machine guns, killing nearly all the horses, and the attempt had to be abandoned.

"The losses of the entire command were remarkably light (1 officer and 1 man killed, 7 officers and 44 men wounded, 48 men captured). Happily all the officers and men of the batteries escaped capture; they were at once supplied with new guns and were in action again in less than two days."

With three batteries in a division, Colonel Preston recommends putting one or even two with the advanced guard. Assuming that the advance guard provides the necessary security, it is hard to see why two batteries should not accompany it. Colonel Preston further recommends that the artillery battalion commander ride with the advanced guard commander. This is of doubtful advisability in the opinion of the writer, as it has always been our policy to have the artillery commander with the division commander. This point, however, is one of interest. Certainly the battalion executive could ride with the advance guard commander and be empowered to make such decisions as the battalion commander himself would.

On the subject of escorts we find that the true rôle of artillery escorts is to provide information, not close protection, and that consequently patrols should search the country in all directions to give timely warning of an attack.

At Huj, the Turks had two battalions of infantry and several machine guns disposed about one field battery, one howitzer battery and one mountain battery. Taking advantage of a slight rise in the ground to one flank, ten troops (about 200 men) of British cavalry got within 800 yards before they were seen. "As the cavalry appeared, the Turks sprang to their guns and swung them around, firing point blank into the charging horsemen. The infantry . . . blazed away with their rifles till they were cut down . . . Many saddles were emptied in that few yards, but the charge was irresistible. In a few minutes the enemy guns were silenced, their crews killed and the whole position in our hands." Most of the

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Turkish infantry escaped as the cavalry was too scattered and cut up to pursue. Poor security work on the part of the Turks.

The outstanding general conclusion that can be deduced from reading of these campaigns is the success of bold use of artillery. Defiladed routes or positions were acceptable when handy, but when conditions demanded, and it often did so, batteries galloped over the open and went into action just as they did in our Civil War. And strange to say most of them survived to fight another day. The charging forces that the guns are supporting, are the ones that get the attention of the enemy's artillery and small arms.

Some of the smaller actions recall vividly Kipling's "The Captain's Jacket," or General Forrest's remark at Brice Crossroads when he routed Sturgis who had double his strength. The fight was in the woods with only one road toward the enemy. His main force was driving ahead dismounted and his reserve had started to gallop down the road toward the Federal lines. He turned to the commanding officer of his only battery, and told him to gallop his battery in the charge, with the remark that "artillery was made to be captured." When the charge succeeded, this battery came into action and did great damage to the retreating enemy.

Give the artillery with cavalry an early warning of moves, a position well up in the marching column, and when the action is joined and the attack starts use it boldly. There is nothing half-hearted or reserved about a cavalry mounted charge, and if necessity demands, there should be the same spirit in its supporting artillery.

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RACING AND TRAINING THE HUNTER.

BY "PARDON."

A YOUNG officer who joined the battery last May and who had one young horse of his own and a Government charger was very keen to ride in the local point-to-points and wrote to me for "tips" as to how to begin to train his horses. The reply that I sent him may help other beginners.

Dear . . . .

If it wasn't for the course that I am on, which doesn't finish till May, I would have been delighted to have sent my horses along with yours. As this is impossible, I have written out the following notes and have enclosed the diary of work which I used in preparing an old hunter of mine, and which proved very successful in his case. Don't think that these few notes exhaust the whole subject, or that because I have put them down they must necessarily be right. You've got to use your own judgment especially in thinking out your work programme, and it is this which makes it such an interesting game. I have put the diary in, as I hadn't the foggiest idea of what to do when I began, and couldn't get much help out of any books, except from "The Horse" by Col. Meysey-Thompson. This I found full of useful hints and I advise you to get hold of and keep it handy for reference.

1. *General.*

Training is a "whole time" job and you'll find it a big tie. If you are going to make a success of it, you can't go away and hand it over to anyone else. Though it has been done, it is difficult to train a horse without another horse to work with him. Try, therefore, and get someone to train his horses with yours—you'll have four horses then to play with, which will make it much easier to arrange for gallops, schools, etc. This will require a good bit of give and take on both sides and I advise you to hold a weekly conference with your partner to fix up the programme for the following week. If there is no one who will help you, you will have to use your groom and may have to teach him whilst you yourself are learning.

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It is only on the "Plain" that the soldier gets anything like the "Downs" so beloved by the real trainer and you will find that you may have to use commons, etc., to do your work on. Get hold of a good map, therefore, of the country round and study the routes you are going to use for this purpose. Try and find two stretches of soft going where you can canter for about two miles. If you've got a racecourse on the station, so much the better. But some horses after a bit go mad at the sight of one and others are inclined to get "nappy" if they do all their work on a course.

Don't be despondent if things don't go right. Something nearly always happens that makes you wonder if you will ever get to the post, and anyhow there is no guarantee that you'll have the luck to be successful your first year. But if you take the trouble to get yourself and your horses fit you'll have safer and pleasanter rides, and you'll learn what to do with the "good-un" when it eventually comes you way. Read all you can on the subject and study the photos in the periodicals, to see how the good jockeys turn out,[1] hold their reins, what gear they use and how they sit going over a fence.

Never refuse an opportunity of visiting a racing stable. Examine the oats and hay they use and see the way the horses are groomed. It will open your eyes and you've got to get your fellow to groom like they do. If you get the chance after you've learnt a bit more, go to a race meeting not with a view to picking the winner, but to watch the exponents in the art performing. It will be money well spent.

Some of my notes only refer to chasing but I have left them in to help you if you decide to have a cut at Sandown later. Besides there isn't as much difference now-a-days between chasing and point-to-pointing as there used to be. If you want a horse to lead you in your work, don't be frightened of asking the "Old Man."[2] Everyone doesn't keep their figure and I know he's got a set of pretty hard-worn racing colours tucked away somewhere. If you have trouble with legs or other ailments, you can't do better

[1] Note Piggott's turn-out on "Jerry M."—It is such small things as the white silk scarf round the neck that tells the hopeless amateur from one who has done a bit of riding. You take good care not to turn our incorrectly on parade. So likewise you must be properly dressed if you ride in point-to-points or in steeplechases. It is expected of you.

[2] The Battery Commander.

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than take "Grumpy's" [1] advice. He loves a good horse and knows one when he sees it. Don't be too ready to buy patent foods and medicines. There's a lot to be said for the "cold water and rest" school.

2. *Grooms and grooming.*

All your work will be wasted unless you can enlist your groom on your side. For half the art of training is good feeding, grooming and stable-management. You can't expect your groom to care, if you show indifference. He will forgive any lack of knowledge and work hard for you if only you are keen and interested. Whilst you get all the enjoyment and glory he gets all the drudgery, so give him a bit extra whilst the training is going on. He will quickly become the arch stable-lad. Never be frightened of discussing your programme with him. He's with the horses all day, and may have some good suggestions to make, especially about the feeding. His views on fitness will probably be rudimentary, as his sole ambition up to date has been to produce a fat horse for you for parade. Your horse will be on a high scale of feeding—he must therefore be groomed really hard. Grooming also acts like a sort of massage on the muscles, and this is especially the case when your horse has come in from doing his work. It will pay you to watch him then whilst he is being "done down" and fed. Don't be to prone to trust your groom till you've proved him to be reliable. I was once hopelessly let down by a groom, who got a swollen head at a critical period.

3. *Feeding and shoeing.*

There are all sorts of tips about feeding. Most of the books on horses are full of them. As long as your horse is feeding well don't worry about them until you have more experience. But make certain that your horses are getting fed at regular intervals, and that there is always a bucket of water in their boxes. This is where your groom comes in, and if he is a good "feeder" he's worth his weight in gold.

The normal horse in hard training eats about 14 lbs. of oats a day (given in five feeds) and 14 to 16 lbs. of hay. It is a popular

[1] The Veterinary Officer i/c of the brigade.

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fallacy that a horse's hay should be cut in training—this is quite wrong—you want him to eat as much as he can. Some horses won't feed at mid-day if they are going to work at 2 p.m., but will feed well later. A good "feeder" knows exactly when his horses will feed and will see that they are fed punctually at these times daily. You'll have to watch this carefully yourself at the start and fix up the times definitely with your groom.

Give your horse a mash on Saturday evening and also after he has done a gallop. Before going out to do a gallop make certain that your linseed is cooking. When you get in warm the water that your horse is going to drink by pouring into it the water off the linseed until the chill is just off it. After he has been "done down" give him his linseed mash and later on let him have his normal oat feeds and hay. Your normal system of feeding should go on until the day prior to that on which you are going to race him—when you should cut his hay down a bit before you leave him for the night, though giving him his usual evening feeds. Your whole idea now being to try and prevent him worrying, or guessing that something out of the way is going to happen. On the day of the race don't give him any hay until he has run. Take away his bedding if necessary or keep him tied up. Give him his usual morning feed and let him have another small feed about four hours before he is due to run, when you can also let him have a small drink. Don't give him anything more until after the race, except to wash his mouth out with some water as you finish saddling up. You will find it will pay you also to miss your lunch on the day of the race, your wind will be much the better for it.

Let him do his work in a light hunting shoe. But get your racing plates made up and fitted about a month before you want them. Don't think that it doesn't matter whether you put racing plates on or not, for every racehorse in England runs in them. Get them put on on the day of the race and taken off the next day. With any luck if they are made of the best steel they will last you for several races.

4. *Work.*

It is a well-nigh impossible task to attempt to train a thin horse as you must have the flesh there to turn into muscle. If your horse

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is in big condition and "hunting fit" six weeks should be ample to train him in. An old horse usually does not require such a hard training as a young one. Most trainers have all their horses out in the early morning, largely because they have to go off racing in the afternoon. Since, however, you have to be on parade at 8.30 a.m., you must fix up your training for the afternoon, arranging to leave your stable punctually each day at 1.30 p.m., fair weather or foul.

Have your plan cut and dried in your own mind of what you are going to do each day before you set out, and try and arrange it so that your horse does his work in the middle of his exercise and comes home as cool as when he went out. Don't let your horse "dawdle about" whilst he's out. Make him walk out when walking—very few horses will do this unless another horse is alongside them—so failing anyone else your groom must accompany you. Don't forget, however, that he's got both horses to do when you get in, so let him jog on ahead when you turn for home. Do your canters quite slowly, the horses either going along side by side or one behind the other. But when galloping send them along all out all the way, if necessary getting a horse to jump off with you and go some of the way and then bringing in another horse near the end to lead you home. It is slow work that builds up the muscles and short quick work that improves the wind and teaches the horse to use his muscles quickly. Many a horse with a "dicky" leg has been trained by walking and trotting up hill. Every time you gallop or school you risk your horse's legs, that is why most trainers nowadays have given up making their horses do the very long gallops that they were called upon to do in the past. You've got to learn to sit still[1] and to keep your hands still also. You'll find when you first start doing canters, etc., that you suffer agonies trying to do this. But once you've developed your muscles you'll get the knack of it and your horse will go easily and collectedly in his work. It will assist you to do this, I think, if you shorten up your stirrups considerably.

The best way to know how your horse is going on in his

[1] Look at Anthony's position on Old Tay Bridge in the photo showing the finish of the 1925 National. Note the position of the hands and the "bridge" made by the reins on the horse's neck. You've got to learn to sit like this in all your work and when you are racing.

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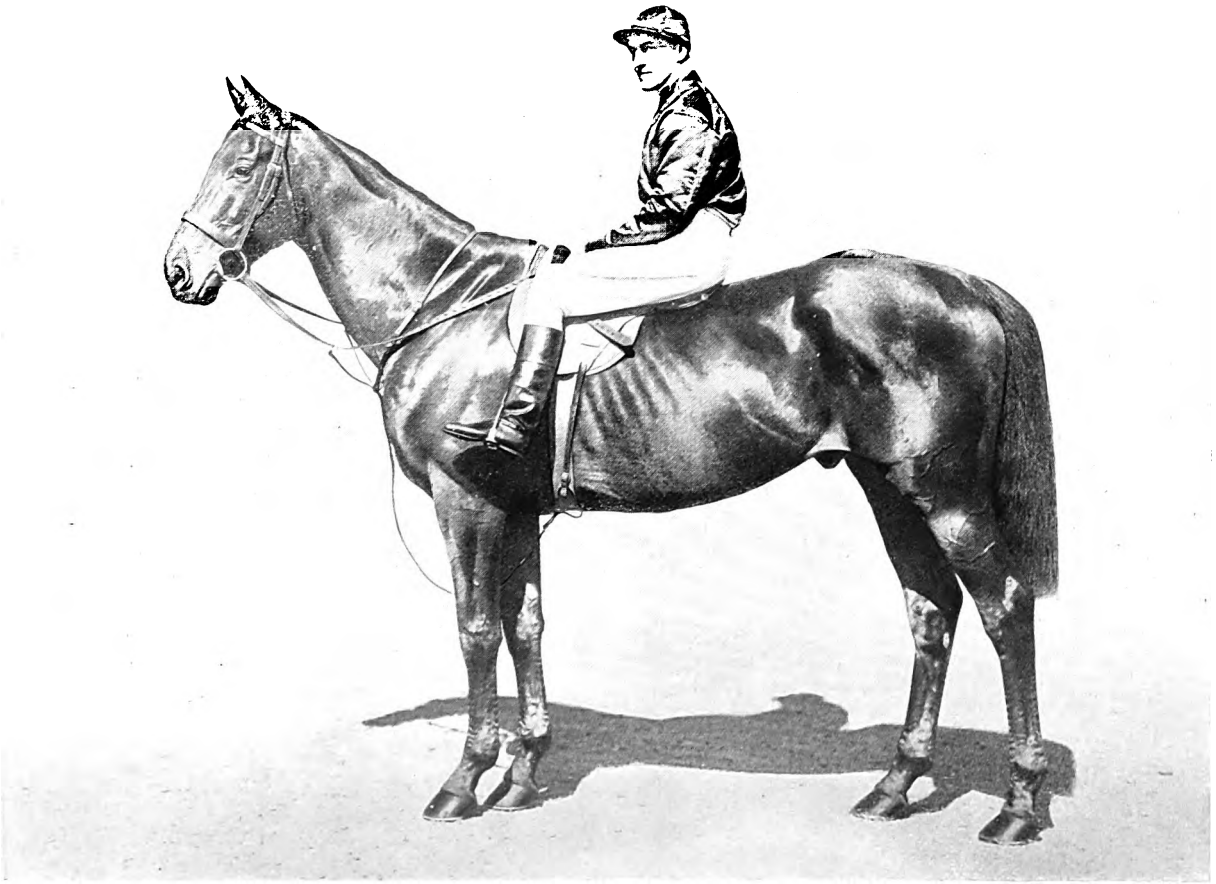

JERRY M. Winner of the National, 1912. E. Piggott up.

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training is by the "feel" he gives you when you're riding him. If you have overdone it he'll feel dead under you and you can hardly kick him along, and he is pretty well certain to go off his feed. Rest and light exercise should, however, soon pull him round again. There are well-known symptoms to tell you how fit he is if you are working on the right lines. He will sweat in his work but will dry clean and there will be no white marks left all over his body. Each muscle will begin to stand out on the forearm and shoulder and the veins will appear more pronounced. And whilst his coat still remains silky looking, the quarters and neck will feel hard and firm. Once you have got condition into a horse it will remain there and not vanish if your horse is thrown out of work for a few days. Indeed, a rest often does more good than harm.

And now a word about the following diary of work. "Bob" was six years old when I started to train him, though he had been raced on the flat as a 4 year old. He was a big strong horse, very excitable and a bit of a handful out hunting. He was always a very good jumper and liked to go fast at his fences, and in all the years I ran him I only remember him falling once, though I often fell off him. When in training he always did 2 to 2½ hours walking and trotting exercise in addition to what I have shown below—except on Sundays when he was rested and groomed. In the week commencing November 5th you will see that he did two long gallops. This was overdoing it, and when I trained him in after years he never did a gallop of more than 1½ miles. I think it much more advisable to try out a horse in a race from which you definitely learn something rather than do long gallops at home.

Diary of Work.

October.		
Monday	31.	1 mile canter.
November.		
Tuesday	1.	1 mile canter.
Wednesday	2.	6 furlong canter.
Thursday	3.	Exercised. (Self hunting.)
Friday	4.	Exercised. (Self in bed with chill.)
Saturday	5.	2 mile canter. (Bob broke away whilst we were changing saddles and cantered home—6 miles.)
Monday	7.	2 mile canter.

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Diary of Work—(continued).

Tuesday	8.	1 mile gallop. (His first gallop. He was paced by 2 other hunters. I was very disappointed over this and thought my horse was hopelessly slow.)
Wednesday	9.	6 furlongs, half speed, twice.
Thursday	10.	Exercised. (Self hunting.)
Friday	11.	6 furlongs, half speed, twice.
Saturday	12.	2½ mile canter.
Monday	14.	6 furlongs, three-quarter speed.
Tuesday	15.	2½ mile canter.
Wednesday	16.	1½ mile gallop. (Paced by three other horses. A better gallop than the last.)
Thursday	17.	Exercised.
Friday	18.	6 furlong canter, twice.
Saturday	19.	3 mile canter.
Monday	21.	3 mile canter.
Tuesday	22.	6 furlongs, three-quarter speed.
Wednesday	23.	1½ miles, half speed.
Thursday	24.	2 mile canter.
Friday	25.	2 mile gallop and schooled. (Went very well over six jumps and then did a good gallop, though I only had one other horse to take him along. He developed cracked heels next day, so feed was cut down and heels dressed with lead lotion.)
Saturday	26.	Laid up and groomed only.
Monday	28.	,, ,, ,, ,, ,,
Tuesday	29.	,, ,, ,, ,, ,,
Wednesday	30.	Exercised.
December.		
Thursday	1.	6 furlong canter.
Friday	2.	2 mile canter.
Saturday	3.	Exercised.
Sunday	4.	5 furlongs, twice, three-quarter speed. (I worked him on Sunday as he had missed his work at the beginning of the week.)
Monday	5.	Schooled and galloped 3 miles. (Jumped six fences and did a splendid gallop, though only one old hunter started with him and then cut in to lead him home.)
Tuesday	6.	5 furlong canter.
Wednesday	7.	2 mile canter.
Thursday	8.	5 furlong, three-quarter speed, twice.
Friday	9.	Schooled and galloped 2½ miles. (Jumped six fences but did a lifeless gallop so I eased him up a bit in his work.)
Saturday	10.	6 furlong canter.
Monday	12.	5 furlong gallop.

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Diary of Work—(continued).

Tuesday	13.	Left for Windsor.
Wednesday	14.	Ran in 3 mile steeplechase and finished well up to four good horses. For the first time out both for myself and the horse, it was an "eye-opener," and I first realised what a good horse I had and I now entered him for several more races.

From December 14th to January 2nd he only did ordinary exercise, owing to frost, snow, and Christmas leave.

January.

Monday	2.	5 furlong canter.
Tuesday	3.	2 mile canter.
Wednesday	4.	1 mile canter and 5 furlong three-quarter speed.
Thursday	5.	Exercised.
Friday	6.	1½ mile canter and 5 furlongs three-quarter speed.
Saturday	7.	5 furlong gallop.
Monday	9.	1½ mile canter, 1 mile gallop.
Tuesday	10.	1½ mile canter, twice.
Wednesday	11.	1½ mile canter, twice.
Thursday	12.	Exercised.
Friday	13.	1 mile, three-quarter speed.
Saturday	14.	Exercised. (Ground too hard to gallop.)
Monday	16.	1½ mile canter.
Tuesday	17.	1½ mile canter, twice.
Wednesday	18.	Hunted (to qualify for certificate).
Thursday	19.	1½ mile canter.
Friday	20.	Schooled. (Pecked and went lame.) So he was laid up. I did not run him at Kempton as I intended to on the 28th, though he was quite sound on the 23rd.
Saturday	28.	Hunted (to qualify—came home quite sound after a long day).
Monday	30.	1½ mile canter, twice.
Tuesday	31.	1 mile gallop.

February.

Wednesday	1.	1½ mile canter.
Thursday	2.	5 furlong. (Pipe opener.)
Friday	3.	Ran in 3 mile steeplechase at Sandown. In this race the second circuit was run at a false pace. All fell except two, and Bob fell at the last fence but two. He was none the worse. He was only exercised for a week and hunted, when a period of frost set in. All work and racing was stopped and he did very little except exercise till March 1st. He then went through a similar preparation to the above for a fortnight, when he ran in a 2½ mile steeplechase at Sandown on March 17th and won it.

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5. *Schooling.*

There is only one cardinal rule here and that is not to overdo it. Your whole object should be to get your horse to jump and jump out at a quicker pace than he has been accustomed to out hunting. He's got to learn to adjust his stride so that he "comes right" at his fences—and recovers and gets away quickly on landing. Don't gallop over more than six fences on each occasion that you school. The last thing you want to do is to make your horse fed up and get him into the habit of refusing. On this account also, if you have to build your own fences, don't make them too high. Always try and get someone to school with you. But if there is no one else your groom must help—though his neck is too valuable to risk over a fence. On occasions I have carried out schooling as follows, though I admit it is dangerous and wants carefully rehearsing.

Start off with your groom beside you to ride at the first fence and as you approach it let him gradually drop about a length behind—and as you jump the fence let him pull out, cut round the wing and gallop ahead of you as you land, repeating the performance at each fence. Its danger lies in the fact that it tends to make your horse attempt to run out. But if well done it sharpens up the "get-away" on landing.

6. *Racing.*

Make yourself thoroughly acquainted with the National Hunt Rules and also with those which govern point-to-points. The former you will find in Ruff's Guide and the latter in Bailey's, both of which are in the Mess. These rules are interpreted in the letter of the law both by Weatherby and Vinton. So be careful at the start, especially over your method of "entering" your horses. Do this in good time till you are thoroughly "au fait" with the procedure, otherwise you may make some silly mistake, your entry will not be accepted, and all your labour will be in vain.

While we are on this subject—no trial at home bears any comparison to a race in public. Thus if you set your mind on winning a certain point-to-point you should if you can manage it have a ride in at least one other race prior to the one you are out to win. It doesn't matter if you have to ride in an "open race,"

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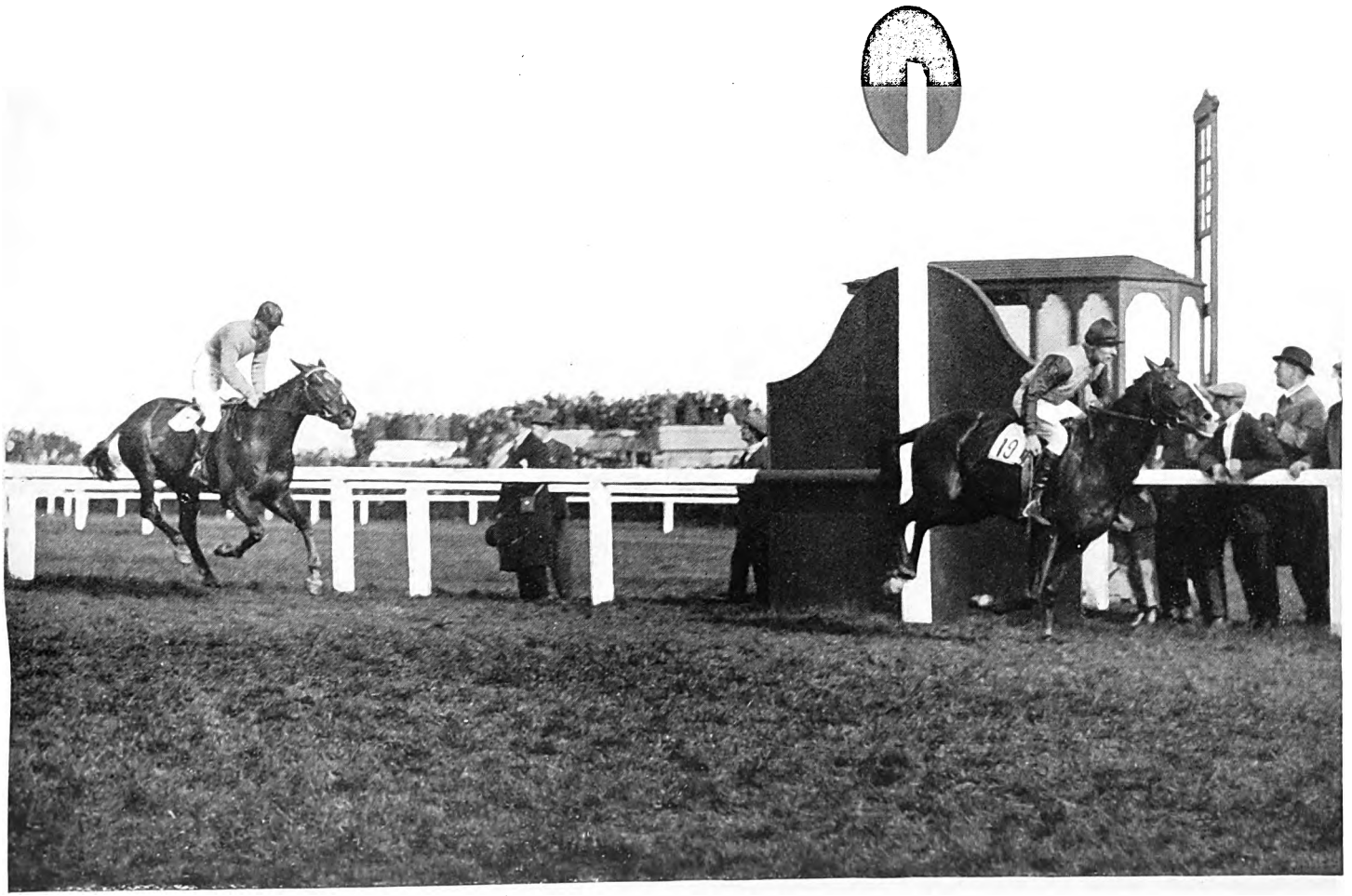
THE FINISH OF THE GRAND NATIONAL, 1925.



Mr. D. Goold's "DOUBLE CHANCE" (Major J. P. Wilson up) beating Mr. W. H. Dixon's "OLD TAY BRIDGE" (J. R. Anthony up).

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it is money well spent, for you'll get a true idea of how fit your horse is—and will then know as nothing else can tell you, what you have got to do to complete his preparation. If you can I should try and run both your horses. You want as much practice as you can get, to do both yourself and your horse justice on the "great day."

Most fellows seem to race nowadays in some sort of a snaffle, with a single rein. It somehow looks as though you hadn't taken any trouble to get yourself fit if you turn out in a double-bridle, and anyhow the four reins are more than the average fellow can handle in a race. Make certain that all your gear is sound beforehand, you get no sympathy if it breaks during a race. Learn to ride with a racing whip or thin stick not more than 2½ ft. long. But don't attempt to use it until you've much more experience. I saw the Imperial Cup at Sandown thrown away one year by the jockey suddenly starting to use his whip. You must sit as still at the finish as you have throughout the race and try and squeeze your horse home with your legs—keep your body bent forward—don't sit on the back of your saddle and flap your arms and legs, it only upsets your horse's stride.[1]

When you are walking round the course, which you should do twice, once prior to and again on the day of the race, don't decide that one fence is more fearful than the others or that you will have to take a pull here and so on. But go round to learn the direction you have got to take after landing over a fence, where the flags are and where the half-way mark is. If you set out thinking of the awful perils ahead of you, you'll surely get the wind up and crash at the fence that you have decided to be the worst. Get to the course early, weigh out in good time and don't forget to have with you and to declare at the scales those things which you are required to by the Rules. I always like to have someone to help me in this and in the saddling up. He's not excited in the way you may be and will notice little things that you might forget. See that the lead put into each half of the weight cloth is approximately equal and that it is packed as far forward as possible. Saddle your horse up in good time, putting the gear on in the following order—

[1] Look at Wilson's position on Double Chance when winning the National of 1925. He only won on the run in.

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number cloth, weight cloth, wither pad, saddle and then girthing-up. Then let your horse walk round the paddock. Before, however, you get up, have another look at the girth to see whether you can't get it up another hole or so.

Keep awake when you get to the start and keep your horse collected. It's silly to let the others get five lengths lead and then be beaten by half a length at the finish. The old idea that a "slack" start in a 3 mile race doesn't matter is out of date. During the race don't be surprised at the pace you are going, go the shortest way round, stick to the horses that are likely to beat you and then, if you can, come away at the end. When nearing the end don't get your horse so placed that you go at a fence three-quarters of a length behind the leader. A tired horse in rear will very often take off when the horse just in front does, and being unable to exert himself sufficiently to clear the extra distance, crashes. If you look at the photo at the beginning of the article, both horses have taken off simultaneously. Look at the extra distance that No 5. has to clear to get over the jump.

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YACHTING IN KASHMIR.

By Major R. M. L. Dutton, o.b.e., m.c., R.A.

"WHERE are you spending your leave?" is a question one often hears in India when the year is young. The answers are various, some satisfactory, some most unsatisfactory. Frequently a young subaltern finds himself unable to answer the question at all and, when he finally has to make up his mind, he drifts to the nearest hill station where he spends a leave which is made up of dances, thé-dansants and tennis—entertainments which, possibly, do not interest him at all. Kashmir is rightly considered the Queen of hot weather resorts as she can cater for a greater variety of pastimes than can rival places, but until quite lately yachting in Kashmir had not been seriously considered. This is strange, as in the Wular Lake she possesses a fine sheet of water which is eminently suitable.

Though in the past a few ardent yachtsmen, notably Duvergne, Biddulph and Blois Johnstone, have sailed on the Wular it was not until the year 1924 that its possibilities were seriously exploited. During that and succeeding years a few keen yachtsmen headed by Major H. G. Grace (Probyn's Horse) have spent their leave in the summer sailing on the lake, with the result that they are of the unanimous opinion that the Wular Lake presents attractions to the yachtsman which rival those of seaport towns of India and are unequalled by any lake in Hindustan.

The Wular Lake is a large, kidney-shaped sheet of water over twenty square miles in extent. It is dominated by Mount Haramukh which rises from its northern and north-eastern shores to nearly 17,000 feet above sea level. On the north, the lake is fed by the waters of the Erin and Madmatti nullahs and on the east the Jhelum enters the lake, to leave it at its southern extremity in the vicinity of Sopor. The shores of the lake, with the exception of the north-eastern area, are fringed with dense masses of water weeds. These weeds need not interfere in any way with navigation on the lake as there is ample water inside the weedy edges to permit of courses of ten to twelve miles being buoyed out in clear, open water, over which yacht racing may take place.

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The north-western shores of the lake are guarded by the shrine of Baba-Shukr-ud-Din, situated on the pinnacle of a hill whose rocky spurs enclose the pretty bays of Kynus and Zirimans. Fishing off the rocky points on these shores gives enjoyment to many keen anglers, and the hills rising from the lake in this area are known to sportsmen as the haunts of black bear and chikor partridge. Duck shooting, in season, round the shores of the lake attracts many visitors. Where the Jhelum runs out of the lake is a willow plantation in which is situated the Ningal Forest Bungalow.

Like all land-locked waters with hills and mountains adjacent to their shores, the Wular Lake is subject to sudden and violent storms at certain seasons of the year. These squalls give ample warning to the weather-wise and do not last more than an hour or so. The yachtsman who sails a suitably designed and well-found yacht need not fear them. Such a design has been carefully chosen under the expert guidance of Colonel S. F. Biddulph, whose knowledge of seamanship and yacht construction is unsurpassed in Northern India. Colonel Biddulph, whose father, General Sir Michael Biddulph was a distinguished Gunner of Crimean and Second Afghan War fame, retired after relinquishing command of Fane's Horse nearly twenty years ago. He now spends the hot weather in Kashmir and the cold weather hawking in the Punjab. The yacht recommended by him is a "Skipjack." The "Skipjack" is an America designed, 19 foot overall, centre-board, cock-pit boat with a foresail and gaff mainsail, carrying in all 275 square feet of canvas. She is a "V" bottomed boat which eminently suits the conditions of the lake, being a stiff little craft with a seven foot beam. In a light wind a crew of two can handle her easily, but in a stiff breeze a third hand is of great assistance. The hull, mast, spars and standing rigging of a skipjack built under the supervision of Colonel Biddulph in Kashmir cost about Rs1200. Messrs. Ratsey & Lapthorne, Cowes, will make a suit of sails for a skipjack together with all the running rigging required for about £34. To this must be added the cost of carriage from England to Kashmir and import custom duties for sails, cost of anchor and a few odds and ends, bringing the total cost of a skipjack completely found up to about Rs1800. So far Colonel Biddulph has superintended the construction of five skipjacks and it is hoped that as the Wular becomes

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more generally known many more will be built. A good plan is for several would-be sailors to club together in buying a boat, and some of the present owners are willing to part with a share of their boats.

During 1927 and 1928 camps have been established near the forest bungalow at Ningal, situated close to where the Jhelum runs out of the lake. Here houseboats were moored either on the banks of the Jhelum or in the Ningal nullah and anything up to a dozen yachtsmen collected together. A triangular course of about three miles was bouyed out and racing round this course or sailing picnics to more distant parts of the lake were of almost daily occurrence. Bathing and aquaplaning helped to occupy time not spent in sailing. Near the forest bungalow is a grass plain on which a golf course could be constructed at small cost. The turf is very good and this course would rival that at Srinagar. Tennis courts could also easily be made. A metalled road runs to Sopor and there is a track thence to the bungalow. This track is about two and a half miles long and is generally fit for motor traffic. The cost of a holiday must, of course, depend largely on individual tastes. In 1928 two officers lived in a comfortable dunga houseboat for Rs 60 per mensem. Their messing cost them Rs 3 per diem each, plus the cost of such European stores as they considered necessary.

It is hoped that we will be able to popularise yachting on the Wular sufficiently to justify the founding of a yacht club, but at present it is too little known. When a club does come into being it will almost certainly be able to arrange with members who are unable to use them, to charter their yachts to members who wish to indulge in the sport in most beautiful surroundings at a height of 5000 feet above sea level and at a distance of over a thousand miles from the sea.

I hope that in this short article I have been able to interest some gunners sufficiently to provide them with one answer to the question with which the article commenced. As there is, at present, no official from whom information concerning this sport can be obtained, I will be delighted to answer any questions that would-be yachting gunners may have on the subject.

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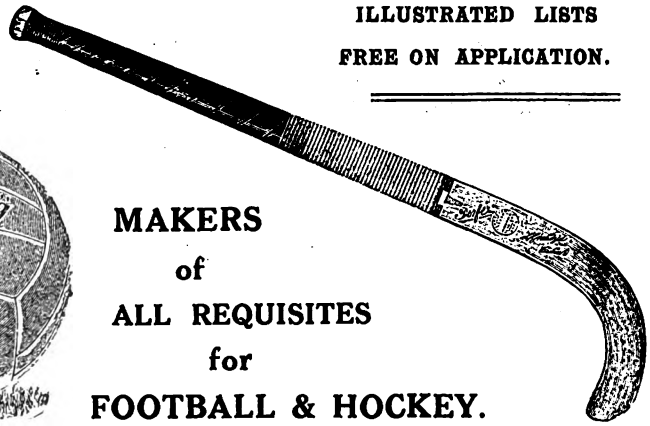

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